

(19)



(11)

EP 2 557 481 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
13.05.2020 Bulletin 2020/20

(51) Int Cl.:
G06F 3/00 (2006.01) G06F 17/20 (2006.01)
G06F 9/06 (2006.01) G06F 3/01 (2006.01)

(21) Application number: **11766095.1**

(86) International application number:
PCT/KR2011/002319

(22) Date of filing: **04.04.2011**

(87) International publication number:
WO 2011/126244 (13.10.2011 Gazette 2011/41)

(54) APPARATUS AND METHOD FOR PROCESSING VIRTUAL WORLD

VORRICHTUNG UND VERFAHREN ZUR VERARBEITUNG EINER VIRTUELLEN WELT

DISPOSITIF ET PROCÉDÉ DE TRAITEMENT D'UN MONDE VIRTUEL

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **05.04.2010 KR 20100031030**

(43) Date of publication of application:
13.02.2013 Bulletin 2013/07

(73) Proprietor: **Samsung Electronics Co., Ltd.**
Gyeonggi-do, 443-742 (KR)

(72) Inventors:
• **HAN, Jae Joon**
Yongin-si
Gyeonggi-do 449-712 (KR)
• **HAN, Seung Ju**
Yongin-si
Gyeonggi-do 449-712 (KR)

• **BANG, Won Chul**
Yongin-si
Gyeonggi-do 449-712 (KR)
• **KIM, Do Kyoong**
Yongin-si
Gyeonggi-do 449-712 (KR)

(74) Representative: **Grootscholten, Johannes A.M. et al**
Arnold & Siedsma
Bezuidenhoutseweg 57
2594 AC The Hague (NL)

(56) References cited:
WO-A1-95/20788 US-A1- 2003 110 001
US-A1- 2005 114 532 US-A1- 2007 024 644
US-A1- 2009 055 126 US-A1- 2009 113 389
US-A1- 2009 150 802 US-A1- 2010 070 885
US-B1- 7 647 415

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 557 481 B1

DescriptionTechnical Field

5 **[0001]** Example embodiments of the following description relate to a method and apparatus for processing a virtual world, and more particularly, to a method and apparatus for applying information of a real world to a virtual world.

Background Art

10 **[0002]** Currently, interest in experience-type games has been increasing. Microsoft Corporation introduced PROJECT NATAL at the "E3 2009" Press Conference. PROJECT NATAL may provide a user body motion capturing function, a face recognition function, and a voice recognition function by combining Microsoft's XBOX 360™ game console with a separate sensor device including a depth/color camera and a microphone array, thereby enabling a user to interact with a virtual world without a dedicated controller. Also, Sony Corporation introduced WAND™ which is an experience-type
 15 game motion controller. The WAND™ enables interaction with a virtual world through input of a motion trajectory of a controller by applying, to the Sony PLAYSTATION™ game console, a location/direction sensing technology obtained by combining a color camera, a marker, and an ultrasonic sensor.

[0003] The interaction between a real world and a virtual world operates in one of two directions. In one direction, data information obtained by a sensor in the real world may be reflected to the virtual world. In the other direction, data
 20 information obtained from the virtual world may be reflected to the real world using an actuator. Example embodiments provide a control system, control method, and commanding structure for applying data obtained by a sensor of a real world to a virtual world, so as to achieve interaction between the real world and the virtual world. WO9520788 relates to a system and method of providing haptic (position, orientation, force, & tactile) feedback to a human operator or a remote or virtual environment.

Disclosure of InventionTechnical Goals

30 Technical solutions

[0004] According to an aspect of the present invention, there is provided a virtual world processing apparatus according to appended claim 1.

35 **[0005]** According to another aspect of the present invention, there is provided a virtual world processing method according to appended claim 11. Preferable features of the invention are defined in the appended dependent claims.

Brief Description of Drawings

40 **[0006]**

FIG. 1 is a view illustrating an operation of manipulating an object of a virtual world using a sensor according to example embodiments;

FIG. 2 is a view illustrating a system manipulating an object of a virtual world using a sensor according to example embodiments;

45 FIG. 3 is a view illustrating a virtual world processing apparatus manipulating an object of a virtual world using a sensor according to other example embodiments;

FIGS. 4 to 6 are views illustrating a sensor and an adaptation real world to virtual world (RV) unit according to example embodiments;

FIGS. 7 to 9 are views illustrating an adaptation VR engine and an actuator according to example embodiments;

50 FIG. 10 is a view illustrating a structure of a virtual world processing apparatus according to example embodiments;

FIG. 11 is a view illustrating a structure of a virtual world processing apparatus according to other example embodiments;

FIG. 12 is a view illustrating a sensor capability base type according to example embodiments;

FIG. 13 is a view illustrating syntax of a sensor capability base type according to example embodiments;

55 FIG. 14 is a view illustrating syntax of sensor capability base attributes according to example embodiments;

FIG. 15 is a view illustrating a sensor adaptation preference base type according to example embodiments;

FIG. 16 is a view illustrating syntax of a sensor adaptation preference base type according to example embodiments;

FIG. 17 is a view illustrating syntax of sensor adaptation preference base attributes according to example embodi-

ments;

FIG 18 is a view illustrating a sensed information base type according to example embodiments;

FIG. 19 is a flowchart illustrating a virtual world processing method according to example embodiments;

FIG 20 is a flowchart illustrating a virtual world processing apparatus according to other example embodiments; and

FIG 21 is a view illustrating an operation of using a virtual world processing apparatus according to example embodiments.

Best Mode for Carrying Out the Invention

[0007] Reference will now be made in detail to embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0008] A term 'object' used herein may include an object, an avatar, and the like implemented in a virtual world.

[0009] Hereinafter, example embodiments will be described in detail with reference to the accompanying drawings.

[0010] FIG. 1 illustrates an operation of manipulating an object 120 of a virtual world using a sensor 100 according to example embodiments.

[0011] Referring to FIG. 1, a user 110 of a real world may manipulate the object 120 of a virtual world, using the sensor 100. The user 110 of the real world may input his or her movement, state, intention, shape, and the like. The sensor 100 may transmit a sensor signal including control information (CI) on the movement, state, intention, shape, and the like, to the virtual world processing apparatus.

[0012] Depending on embodiments, the user 110 of the real world may include a humanbeing, an animal, a plant, and an inanimate matter such as an object, and even environments of the user 110.

[0013] FIG 2 illustrates a system that manipulates an object of a virtual world using a sensor according to example embodiments.

[0014] Referring to FIG. 2, a sensor signal including CI 201 related to a movement, state, intention, shape, and the like of a user of a real world 210 may be input through a sensor, which is a device of the real world 210, and transmitted to a virtual world processing apparatus. Depending on embodiments, the CI 201 related to the movement, state, intention, shape, and the like of the user of the real world 210 may include sensor capability, sensor adaptation preference, and sensed information, which will be described in details with reference to FIGS. 12 to 21.

[0015] The virtual world processing apparatus may include an adaptation real world to virtual world (RV) 220. Depending on embodiments, the adaptation RV 220 may be implemented by an RV engine. The adaptation RV 220 may convert information on the real world 210 into information applicable to a virtual world 240, using the CI 201 related to the movement, state, intention, shape, and the like of the user of the real world 210 and included in the sensor signal.

[0016] Depending on embodiments, the adaptation RV 220 may convert virtual world information (VWI) 202 using the CI 201 related to the movement, state, intention, shape, and the like of the user of the real world 210.

[0017] The VWI 202 may denote information on the virtual world 240. For example, the VWI 202 may include information on an object of the virtual world 240 or elements constituting the object.

[0018] The virtual world processing apparatus may transmit the converted information 203 converted by the adaptation RV 220 to the virtual world 240, through an adaptation RV/virtual world to real world (RV/VR) 230.

[0019] Table 1 illustrates structures shown in FIG. 2.

[Table 1]

SIDC	Sensory input device capabilities. Another expression of Sensor capability.	VWI	Virtual world information
USIP	User sensory input preferences. Another expression of sensor adaptation preference.	SODC	Sensory output device capabilities
SIDCmd	Sensory input device commands. Another expression of Sensed information.	USOP	User sensory output preferences
vw	Virtual world capabilities	SODCmd	Sensory output device commands
VWP	Virtual world preferences	SEM	Sensory effect metadata
VWEM	Virtual world effect metadata	SI	Sensory information

[0020] FIG 3 illustrates a virtual world processing apparatus manipulating an object of a virtual world using a sensor

according to other example embodiments.

[0021] Referring to FIG 3, the virtual world processing apparatus may include a sensor 250, an adaptation RV unit 255, and an adaptation VR unit 260.

[0022] The sensor 250 may collect information on the movement, state, intention, shape, and the like of a user of a real world. The information collected by the sensor 250 may include sensed information.

[0023] Depending on embodiments, the sensor 250 may include an input unit. The input unit may be input with sensor adaptation preference by the user of the real world.

[0024] The sensor 250 may encode information on sensor capability into first metadata, and transmit the first metadata to the adaptation RV unit 255.

[0025] The sensor 250 according to example embodiments may generate the first metadata by encoding the information on sensor capability into a binary format. The first metadata encoded into the binary format may include binary encoding syntax, a number of bits of attributes of the binary encoding syntax, and a type of the attributes of the binary encoding syntax. The sensor 250 may transmit the first metadata encoded into the binary format to the adaptation RV unit 255.

[0026] In addition, the sensor 250 may generate the first metadata by encoding the information on sensor capability into an eXtensible Markup Language (XML) format. The sensor 250 may transmit the first metadata encoded into the XML format to the adaptation RV unit 255.

[0027] The sensor 250 may generate the first metadata by encoding the information on sensor capability into the XML format and then encoding the information encoded into the XML format into a binary format. The sensor 250 may transmit the first metadata encoded into the binary format to the adaptation RV unit 255.

[0028] In addition, the sensor 250 may encode information collected from the real world into fourth metadata, and transmit the fourth metadata to the adaptation RV unit 255.

[0029] According to example embodiments, the sensor 250 may generate the fourth metadata by encoding the information collected from the real world into the binary format. Here, the fourth metadata encoded into the binary format may include the binary encoding syntax, the number of bits of the attributes of the binary encoding syntax, and the type of the attributes of the binary encoding syntax. The sensor 250 may transmit the first metadata encoded into the binary format to the adaptation RV unit 255.

[0030] The sensor 250 may generate the fourth metadata by encoding the information collected from the real world into the XML format. The sensor 250 may transmit the fourth metadata encoded into the XML format to the adaptation RV unit 255.

[0031] The sensor 250 may generate the fourth metadata by encoding the information collected from the real world into the XML format and encoding the information encoded into the XML format into the binary format. The sensor 250 may transmit the fourth metadata encoded into the binary format to the adaptation RV unit 255.

[0032] Depending on embodiments, the sensor 250 may include a metadata encoder 251.

[0033] The metadata encoder 251 may encode the information on the sensor capability into the first metadata. In this case, the sensor may transmit the first metadata to the adaptation RV unit 255.

[0034] In addition, the metadata encoder 251 may encode the information collected from the real world into the fourth metadata.

[0035] A metadata decoder 256 included in the adaptation RV unit 255 may decode the first metadata received from the sensor 250.

[0036] Depending on embodiments, the metadata encoder 251 may include at least one of an XML encoder that encodes the information on the sensor capability or the information collected from the real world into data of the XML format and a binary encoder that encodes the foregoing information into data of the binary format.

[0037] The metadata decoder 256 may include at least one of an XML decoder that decodes received data of the XML format or a binary decoder that decodes received data of the binary format.

[0038] Hereinafter, referring to FIGS. 2C to 2E, a description will be made about example embodiments in which the sensor 250 encodes the information on the sensor capability and example embodiments in which the adaptation RV unit 255 decodes received data.

[0039] FIGS. 4 to 6 illustrate a sensor and an adaptation RV unit according to example embodiments.

[0040] Referring to FIG. 4, a sensor 271 according to an embodiment may include an XML encoder 272. The XML encoder 272 may encode information on sensor capability of the sensor 271 into metadata of the XML format. The XML encoder 272 may encode information collected from the real world, for example sensed information, into metadata of the XML format.

[0041] In addition, the sensor 271 may transmit the metadata encoded by the XML encoder 272 to an adaptation RV unit 274.

[0042] The adaptation RV unit 274 may include an XML decoder 273. The XML decoder 273 may decode the metadata received from the sensor 271.

[0043] Referring to FIG. 5, a sensor 275 according to an embodiment may include an XML encoder 276 and a binary encoder 277. The XML encoder 276 may encode information on sensor capability of the sensor 275 into the XML format.

Additionally, the XML encoder 276 may encode information collected from the real world, for example sensed information, into the XML format.

[0044] The binary encoder 277 may encode the data encoded by the XML encoder 276 into metadata of the binary format.

[0045] The sensor 275 may transmit the metadata encoded by the XML encoder 276 and the binary encoder 277 to an adaptation RV unit 280.

[0046] The adaptation RV unit 280 may include a binary decoder 278 and an XML decoder 279. The binary decoder 278 may decode the metadata received from the sensor 275. The XML decoder 279 may decode again the data decoded into the XML format by the binary decoder 278.

[0047] Referring to FIG. 6, a sensor 281 according to an embodiment may include a binary encoder 282. The binary encoder 282 may encode information on sensor capability of the sensor 271 into metadata of the binary format. Additionally, the binary encoder 282 may encode information collected from the real world by the sensor 281, for example sensed information, into the binary format.

[0048] In addition, the sensor 281 may transmit the metadata encoded by the binary encoder 282 to an adaptation RV unit 284.

[0049] The adaptation RV unit 284 may include a binary decoder 283. The binary decoder 283 may decode the metadata received from the sensor 281.

[0050] Referring back to FIG 3, the adaptation VR unit 260 may encode information on a virtual world 265 into second metadata.

[0051] The adaptation VR unit 260 may generate second metadata by encoding the information on the virtual world 265 into the binary format. Here, the second metadata encoded into the binary format may include binary encoding syntax, a number of bits of attributes of the binary encoding syntax, and a type of the attributes of the binary encoding syntax. The adaptation VR unit 260 may transmit the second metadata encoded into the binary format to the adaptation RV unit 255.

[0052] In addition, the adaptation VR unit 260 may generate the second metadata by encoding information collected from the virtual world 265 into the XML format and encoding the information encoded into the XML format into the binary format. The adaptation VR unit 260 may transmit the second metadata encoded into the binary format to the adaptation RV unit 255.

[0053] Depending on embodiments, the adaptation VR unit 260 may include an metadata encoder 262. The metadata encoder 262 may encode the information on the virtual world 265 into the second metadata.

[0054] Depending on embodiments, the metadata encoder 262 may include at least one of an XML encoder that encodes the information on the virtual world 265 into metadata of the XML format and a binary encoder that encodes the information on the virtual world 265 into metadata of the binary format.

[0055] Depending on embodiments, the metadata encoder 262 may include the XML encoder which encodes the information on the virtual world 265 into data of the XML format.

[0056] The metadata encoder 262 may further include the XML encoder and the binary encoder. The XML encoder may encode the information on the virtual world 265 into the data of the XML format. The binary encoder may encode the data of the XML format back to data of the binary format.

[0057] In addition, the metadata encoder 262 may include the binary encoder which encodes the information on the virtual world 265 into data of the binary format.

[0058] The adaptation RV unit 255 may generate information to be applied to the virtual world 265, based on first metadata encoded from the information on sensor capability received from the sensor 250 and second metadata encoded from the information on the virtual world received from the adaptation VR unit 260. Here, the adaptation RV unit 255 may encode the generated information into third metadata.

[0059] Depending on embodiments, the adaptation RV unit 255 may generate the information to be applied to the virtual world 265, based on the first metadata encoded from the information on sensor capability received from the sensor 250, the fourth metadata encoded from the information collected from the real world, for example the sensed information, and the second metadata encoded from the information on the virtual world 265. In this instance, the adaptation RV unit 255 may encode the generated information into the third metadata.

[0060] Depending on embodiments, the adaptation RV unit 255 may include a metadata decoder 256, a metadata decoder 258, and a metadata encoder 257.

[0061] The adaptation RV unit 255 may generate the information to be applied to the virtual world 265, based on information decoded from the first metadata and information decoded from the second metadata by the metadata decoder 258. That is, the adaptation RV unit 255 may generate the information to be applied to the virtual world 265 to correspond to virtual world object characteristics included in the second metadata and the sensed information.

[0062] Depending on embodiments, the adaptation RV unit 255 may generate the information to be applied to the virtual world 265, based on the information decoded from the first metadata by the metadata decoder 256, that is, the information on sensor capability, the information decoded from the fourth metadata, that is, the sensed information, and

the information decoded from the second metadata by the metadata decoder 258, that is, the information on the virtual world 265. Here, the adaptation RV unit 255 may generate the information to be applied to the virtual world 265 to correspond to the virtual world object characteristics included in the second metadata and the sensed information.

[0063] The metadata encoder 257 may encode the information to be applied to the virtual world 265, which is generated by the adaptation RV unit 255, into the third metadata. In addition, the adaptation RV unit 255 may transmit the third metadata to the adaptation VR unit 260.

[0064] According to an aspect, the adaptation VR unit 260 may include a metadata decoder 261. The metadata decoder 261 may decode the third metadata. The adaptation VR unit 260 may convert attributes of an object of the virtual world 265 based on the decoded information. Also, the adaptation VR unit 260 may apply the converted attributes to the virtual world 265.

[0065] The virtual world processing system may transmit the information on the virtual world 265 to an actuator of the real world to reflect the information on the virtual world 265 to the real world. Hereinafter, example embodiments to reflect the information on the virtual world 265 to the real world will be described in detail with reference to FIGS. 7 to 9.

[0066] FIGS. 7 to 9 illustrate an adaptation VR engine and an actuator according to example embodiments.

[0067] Referring to FIG. 7, an adaptation RV engine 285 may include an XML encoder 286. The adaptation VR engine 285, as an embodiment of the adaptation RV unit 255 illustrated in FIG. 3, may transmit the information on the virtual world 265 to an actuator 288 of the real world so that the information on the virtual world 265 is reflected to the real world.

[0068] The adaptation VR unit 260 may collect information on change in the attributes of the object and transmit the collected information to the adaptation VR engine 285. The adaptation VR engine 285 may include an XML encoder 286. The XML encoder 286 may encode the received information on the virtual world 265 into data of the XML format. In addition, the adaptation VR engine 285 may transmit the data encoded by the XML encoder 286 to the actuator 288.

[0069] The actuator 288 may include an XML decoder 287. The XML decoder 287 may decode the data of the XML format received from the adaptation VR engine 285.

[0070] The actuator 288 may operate in response to the information decoded by the XML decoder 287.

[0071] Referring to FIG. 8, an adaptation VR engine 290 may include an XML encoder 291 and a binary encoder 292.

[0072] The adaptation VR unit 290 may collect the information on change in attributes of an object of the virtual world 265 and transmit the collected information to the adaptation VR engine 290. The adaptation VR engine 290 may include the XML encoder 291 and the binary encoder 292. The XML encoder 291 may encode the received information on the virtual world 265 into data of the XML format. The binary encoder 292 may encode the data encoded by the XML encoder 291 back to data of the binary format. In addition, the adaptation VR engine 290 may transmit the data encoded by the binary encoder 292 to an actuator 295.

[0073] The actuator 295 may include a metadata decoder 293 and an XML decoder 294. The binary decoder 293 may decode the data of the binary format received from the adaptation VR engine 290 into the data of the XML format. The XML decoder 294 may decode the data decoded into the XML format by the binary decoder 293.

[0074] The actuator 295 may operate in response to the information decoded by the XML decoder 294.

[0075] Referring to FIG. 9, the adaptation VR engine 296 may include a binary encoder 297.

[0076] The adaptation VR unit 260 may collect information on change in attributes of an object of the virtual world 265 and transmit the collected information to the adaptation VR engine 296. The adaptation VR engine 296 may include an XML encoder 297. The XML encoder 297 may encode the received information on the virtual world 265 into data of the XML format. In addition, the adaptation VR engine 296 may transmit the data encoded by the binary encoder 297 to an actuator 299.

[0077] The actuator 299 may include a binary decoder 298. The binary decoder 298 may decode the data of the binary format received from the adaptation VR engine 296.

[0078] The actuator 299 may operate in response to the information decoded by the binary decoder 298.

[0079] FIG 10 illustrates a structure of a virtual world processing apparatus 300 according to example embodiments.

[0080] Referring to FIG 10, the virtual world processing apparatus 300 may include a storage unit 310 and a processing unit 320.

[0081] The storage unit 310 may store sensor capability related to a sensor.

[0082] The sensor refers to a device to measure a movement, state, intention, shape, and the like of a user of a real world. The sensor may be implemented by a sensory input device. Depending on embodiments, the sensor may be classified based on sensor types including (1) acoustic, sound, vibration, (2) automotive, transportation, (3) chemical, (4) electric current, electric potential, magnetic, radio, (5) environment, weather, (6) flow, (7) ionizing radiation, subatomic particles, (8) navigation instruments, (9) position, angle, displacement, distance, speed, acceleration, (10) optical, light, imaging, (11) pressure, force, density, level, (12) thermal, heat, temperature, (13) proximity, presence, and (14) sensor technology.

[0083] Table 2 shows example embodiments of the sensor according to the sensor types. However, the sensors introduced in Table 2 are only example embodiments but are not limiting.

[Table 2]

sensor type	list of sensors
(1) acoustic, sound, vibration	geophone
	hydrophone
	lace sensor, a guitar pickup
	microphone
	seismometer
	accelerometer
(2) automotive, transportation	crank sensor
	curb feeler
	defect detector
	map sensor
	parking sensors
	parktronic
	radar gun
	speedometer
	speed sensor
	throttle position sensor
	variable reluctance sensor
	wheel speed sensor
(3) chemical	breathalyzer
	carbon dioxide sensor
	carbon monoxide detector
	catalytic bead sensor
	chemical field-effect transistor
	electronic nose
	electrolyte-insulator-semiconductor sensor
	hydrogen sensor
	infrared point sensor
	ion-selective electrode
	nondispersive infrared sensor
	microwave chemistry sensor
	nitrogen oxide sensor
	optode
	oxygen sensor
	pellistor
	pH glass electrode
	potentiometric sensor
	redox electrode

EP 2 557 481 B1

(continued)

	sensor type	list of sensors
5		smoke detector
		zinc oxide nanorod sensor
10	(4) electric current, electric potential, magnetic, radio	ammeter
		current sensor
		galvanometer
		hall effect sensor
		hall probe
15		leaf electroscope
		magnetic anomaly detector
		magnetometer
20		metal detector
		multimeter
		ohmmeter
25		voltmeter
	(5) environment, weather	watt-hour meter
		fish counter
		gas detector
30		hygrometer
		pyranometer
		pyrgeometer
		rain gauge
35		rain sensor
	(6) flow	seismometers
		air flow meter
40		flow sensor
		gas meter
		mass flow sensor
	(7) ionizing radiation, subatomic particles	water meter
45		bubble chamber
		cloud chamber
		geiger counter
50		neutron detection
		particle detector
		scintillation counter
55		scintillator
	(8) navigation instruments	wire chamber
		air speed indicator
		altimeter

EP 2 557 481 B1

(continued)

sensor type	list of sensors
	attitude indicator
	fluxgate compass
	gyroscope
	inertial reference unit
	magnetic compass
	MHD sensor
	ring laser gyroscope
	turn coordinator
	variometer
	vibrating structure gyroscope
	yaw rate sensor
(9) position, angle, displacement, distance, speed, acceleration	accelerometer
	inclinometer
	laser rangefinder
	linear encoder
	linear variable differential transformer (LVDT)
	liquid capacitive inclinometers
	odometer
	piezoelectric accelerometer
	position sensor
	rotary encoder
	rotary variable differential transformer
	selsyn
	tachometer
(10) optical, light, imaging	charge-coupled device
	colorimeter
	infra-red sensor
	LED as light sensor
	nichols radiometer
	fiber optic sensors
	photo diode
	photomultiplier tubes
	phototransistor
	photoelectric sensor
	photoionization detector
	photomultiplier
	photoresistor
	photos witch

EP 2 557 481 B1

(continued)

sensor type	list of sensors
5 10	phototube
	proximity sensor
	scintillometer
	shack-Hartmann
	wavefront sensor
15 20 25 30	(11) pressure, force, density, level
	anemometer
	bhangmeter
	barograph
	barometer
	hydrometer
	Level sensor
	Load cell
	magnetic level gauge
	oscillating U-tube
	pressure sensor
	piezoelectric sensor
	pressure gauge
	strain gauge
	torque sensor
	viscometer
35 40 45	(12) thermal, heat, temperature
	bolometer
	calorimeter
	heat flux sensor
	infrared thermometer
	micro bolometer
	microwave radiometer
	net radiometer
	resistance temperature detector
	resistance thermometer
	thermistor
	thermocouple
	thermometer
50 55	(13) proximity, presence
	alarm sensor
	bedwetting alarm
	motion detector
	occupancy sensor
	passive infrared sensor
	reed switch

(continued)

sensor type	list of sensors
5	stud finder
	triangulation sensor
	touch switch
	wired glove
10 15 20 25 30 35 40	(14) sensor technology active pixel sensor
	machine vision
	biochip
	biosensor
	capacitance probe
	catadioptric sensor
	carbon paste electrode
	displacement receiver
	electromechanical film
	electro-optical sensor
	image sensor
	inductive sensor
	intelligent sensor
	lab-on-a-chip
	leaf sensor
	RADAR
	sensor array
	sensor node
	soft sensor
	staring array
	transducer
	ultrasonic sensor
	video sensor

[0084] For example, the microphone belonging to a sensor type (1) acoustic, sound, and vibration may collect voice of the user of the real world and ambient sounds of the user. The speed sensor belonging to the sensor type (2) automotive and transportation may measure speed of the user of the real world and speed of an object such as a vehicle of the real world. The oxygen sensor belonging to the sensor type (3) chemical may measure an oxygen ratio in ambient air around the user of the real world and an oxygen ratio in liquid around the user of the real world. The metal detector belonging to the sensor type (4) electric current, electric potential, magnetic, and radio may detect metallic substances present in or around the user of the real world. The rain sensor belonging to the sensor type (5) environment and weather may detect whether it is raining in the real world. The flow sensor belonging to the sensor type (6) flow may measure a ratio of a fluid flow of the real world. The scintillator belonging to the sensor type (7) ionizing radiation and subatomic particles may measure a ratio or radiation present in or around the user of the real world. The variometer belonging to the sensor type (8) navigation instruments may measure a vertical movement speed of or around the user of the real world. The odometer belonging to the sensor type (9) position, angle, displacement, distance, speed, and acceleration may measure a traveling distance of an object of the real world, such as a vehicle. The phototransistor belonging to the sensor type (10) optical, light, and imaging may measure light of the real world. The barometer belonging to the sensor type (11)

pressure, force, density, and level may measure an atmospheric pressure of the real world. The bolometer belonging to the sensor type (12) thermal, heat, and temperature may measure radiation rays of the real world. The motion detector belonging to the sensor type (13) proximity and presence may measure a motion of the user of the real world. The biosensor belonging to the sensor type (14) may measure biological characteristics of the user of the real world.

[0085] FIG 11 illustrates a structure of a virtual world processing apparatus 350 according to other example embodiments.

[0086] Referring to FIG. 11, an input device 360 may be input with sensor adaptation preference 361 from a user of a real world. Depending on embodiments, the input device 360 may be inserted in the form of a module in a sensor 370 or the virtual world processing apparatus 350. The sensor adaptation preference 361 will be described in further detail with reference to FIGS. 15 to 17.

[0087] The sensor 370 may transmit sensor capability 371 and sensed information 372 to the virtual world processing apparatus 350. The sensor capability 371 and the sensed information 372 will be described in further detail with reference to FIGS. 12 to 14, and 18.

[0088] The virtual world processing apparatus 350 may include a signal processing unit 351 and an adaptation unit 352.

[0089] The signal processing unit 351 may receive the sensor capability 371 and the sensed information 372 from the sensor 370, and perform signal processing with respect to the sensor capability 371 and the sensed information 372. Depending on embodiments, the signal processing unit 351 may perform filtering and validation with respect to the sensor capability 371 and the sensed information 372.

[0090] The adaptation unit 352 may receive sensor adaptation preference 361 from the input device 360, and perform adaptation with respect to the information processed by the signal processing unit 351 based on the received sensor adaptation preference 361, so that the processed information is applied to a virtual world 380. Furthermore, the virtual world processing apparatus 350 may apply the information having undergone the adaptation by the adaptation unit 352 to the virtual world 380.

[0091] The sensor capability 371 refers to information on capability of the sensor 370.

[0092] The sensor capability base type may refer to a base type of the sensor capability. Depending on embodiments, the sensor capability base type may be a base abstract type of the metadata related to sensor capability commonly applied to all types of sensors, as part of metadata types related to the sensor capability.

[0093] Hereinafter, the sensor capability and the sensor capability base type will be described in detail with reference to FIGS. 12 to 14.

[0094] FIG. 12 illustrates a sensor capability base type 400 according to example embodiments.

[0095] Referring to FIG. 12, the sensor capability base 400 may include sensor capability base attributes 410 and any attributes 420.

[0096] The sensor capability base attributes 410 denote a group of sensor capabilities basically included in the sensor capability base type 400.

[0097] The any attributes 420 denote a group of additional sensor capabilities of a sensor. The any attributes 420 may be unique additional sensor capabilities applicable to an arbitrary sensor. The any attributes 420 may allow for the inclusion of any attributes defined within a namespace other than the target namespace.

[0098] FIG. 13 illustrates syntax 500 of a sensor capability base type according to example embodiments.

[0099] Referring to FIG. 13, the syntax 500 of the sensor capability base type may include a diagram 510, attributes 520, and a source 530.

[0100] The diagram 510 may include a diagram of the sensor capability base type.

[0101] The attributes 520 may include sensor capability base attributes and any attributes.

[0102] The source 530 may include a program representing the sensor capability base type using an XML. However, the source 530 shown in FIG. 13 is suggested by way of example but not limiting.

[0103] Table 2-2 shows a source of a sensor capability base type according to other example embodiments.

[Table 2-2]

<!-- ##### -->

(continued)

```

<!-- Sensor Capability base type -->
<!-- ##### -->
5 <complexType name="SensorCapabilityBaseType" abstract="true">
    <complexContent>
        <extension base="dia:TerminalCapabilityBaseType">
            <sequence>
                <element name="Accuracy"
10 type="cidl:AccuracyType" minOccurs="0"/>
            </sequence>
            <attributeGroup
                ref="cidl:SensorCapabilityBaseAttributes"/>
        </extension>
    </complexContent>
</complexType>
15 <complexType name="AccuracyType" abstract="true">
    <complexContent>
        <restriction base="anyType"/>
    </complexContent>
</complexType>
20 <complexType name="PercentAccuracy">
    <complexContent>
        <extension base="cidl:AccuracyType">
            <attribute name="value"
25 type="mpeg7:zeroToOneType"/>
        </extension>
    </complexContent>
</complexType>
<complexType name="ValueAccuracy">
    <complexContent>
        <extension base="cidl:AccuracyType">
30 <attribute name="value" type="float"/>
        </extension>
    </complexContent>
</complexType>

```

[0104] Table 2-3 shows binary representation syntax corresponding to the sensor capability base type according to the example embodiments.

[Table 2-3]

SensorCapabilityBaseType {	Number of bits	Mnemonic
AccuracyFlag	1	bslbf
TerminalCapabilityBase		TerminalCapabilityBaseType
if(AccuracyFlag) {		
Accuracy		AccuracyType
}		
SensorCapabilityBaseAttributes		SensorCapabilityBaseAttributesType
}		
AccuracyType {		
AccuracySelect	2	bslbf
if(AccuracySelect = 00){		
PercentAccuracy		mpeg7:zeroToOneType

(continued)

SensorCapabilityBaseType {	Number of bits	Mnemonic
}else if (AccuracySelect==01) {		
ValueAccuracy	32	fsbf
}		
}		

[0105] Table 2-4 shows descriptor components semantics corresponding to the the sensor capability base type according to the example embodiments.

[Table 2-4]

Names	Description
SensorCapabilityBaseType	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
AccuracyFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
TerminalCapabilityBase	
Accuracy	Describes the degree of closeness of a measured quantity to its actual value in AccuracyType.
SensorCapabilityBaseAttributes	Describes a group of attributes for the sensor capabilities.
AccuracyType	Becomes a parent type providing a choice of describing the accuracy in either relative value or absolute value.
AccuracySelect	This field, which is only present in the binary representation, describes which accuracy scheme shall be used. "0" means that the PercentAccuracy type shall be used, and "1" means that the ValueAccuracy type shall be used.
PercentAccuracy	Describes the degree of closeness of a measured quantity to its actual value in a relative way using a value ranging from 0 to 1.0.
ValueAccuracy	Describes the degree of closeness of a measured quantity to its actual value in an absolute value of given unit.

[0106] FIG. 14 illustrates syntax of sensor capability base attributes according to example embodiments.

[0107] Referring to FIG. 14, the syntax 600 of the sensor capability base attributes may include a diagram 610, attributes 620, and a source 630.

[0108] The diagram 610 may include a diagram of the sensor capability base attributes.

[0109] The attributes 620 may include a unit 601, a maximum value (maxValue) 602, a minimum value 603 (minValue), an offset 604, a number of levels (numOflevels) 605, a sensitivity 606, a signal to noise ratio (SNR) 607, and an accuracy 608.

[0110] The unit 601 is a unit of values measured by a sensor. Depending on embodiments, for example, when the sensor is a thermometer, the unit 601 may be Celsius (°C) and Fahrenheit (°F). When the sensor is a speed sensor, the unit 601 may be kilometers per hour (km/h) and meters per second (m/s).

[0111] The maxValue 602 and the min Value 603 denote a maximum value and a minimum value measurable by the sensor, respectively. Depending on embodiments, for example, when the sensor is a thermometer, the maxValue 602 may be 50°C and the min Value 603 may be 0°C. Even in the same type of sensor, for example, the thermometer, the maxValue 602 and the min Value 603 may be varied according to use and function of the sensor.

[0112] The offset 604 denotes an offset value added to a value measured by the sensor to obtain an absolute value.

Depending on embodiments, for example, presuming that the sensor is a speed sensor and a user or an object of a real world stays still, when a value other than zero is measured as speed, the sensor may determine the offset 604 to a value making the speed zero. For example, when -1km/h is measured as speed of a vehicle of the real world, the offset 604 may be 1km/h.

[0113] The numOflevels 605 denotes a number of values measurable by the sensor. Depending on embodiments, for example, presuming that the sensor is a thermometer and the maximum value and the minimum value are 50°C and 0°C, respectively, when the numOflevels 605 is 5, the sensor may measure five values, that is, 10°C, 20°C, 30°C, 40°C, and 50°C. Even when temperature of the real world is 27°C, not only when 20°C, the temperature may be measured as 20°C through round-down. Alternatively, in this case, the temperature may be measured as 30°C through roundup.

[0114] The sensitivity 606 denotes a minimum input value required for the sensor to measure an output value. Depending on embodiments, for example, when the sensor is a thermometer and the sensitivity 606 is 1°C, the sensor may not measure a temperature change less than 1°C but measure only the temperature change of at least 1°C. For example, when the temperature in the real world increases from 15°C to 15.5°C, the sensor may measure the temperature still as 15°C.

[0115] The SNR 607 denotes a relative degree of a signal measured by the sensor with respect to a noise. Depending on embodiments, presuming that the sensor is a microphone to measure and a vocal sound of the user of the real world, when an ambient noise is large, the SNR 607 of the sensor may be relatively small.

[0116] The accuracy 608 denotes an error of the sensor. Depending on embodiments, when the sensor is a microphone, the accuracy 608 may be a measurement error caused by variation of a propagation speed of a sound according to temperature, humidity, and the like. Alternatively, the accuracy 608 of the sensor may be determined through a statistical error of the values already measured by the sensor.

[0117] Depending on embodiments, the accuracy 608 may be expressed by two methods, which are a percent accuracy method and a value accuracy method.

[0118] The percent accuracy method may express the accuracy of the measured value with respect to an available measurement range. The accuracy 608 may be expressed by values between 0 and 1.

[0119] The value accuracy method may express the accuracy 608 using a difference between the measured value and an actual value.

[0120] Depending on embodiments, the attributes 620 may further include a position. The position denotes a position of the sensor. When the sensor is a thermometer, the position of the sensor may be an armpit of the user of the real world. The position may include longitude and latitude, and height and direction from a ground surface.

[0121] The unit 601, the maximum value 602, the minimum value 603, the offset 604, the number of levels 605, the sensitivity 606, the SNR 607, the accuracy 608, and the position, as the sensor capability base attributes, may be rearranged as shown in Table 3.

[Table 3]

Name	Definition
Unit 601	the unit of value
max Value 602	the maximum value that the input device (sensor) can provide. The terms will be different according to the individual device type.
minValue 603	the minimum value that the input device (sensor) can provide. The terms will be different according to the individual device type.
Offset 604	the number of value locations added to a base value in order to get to a specific absolute value.
numOflevels 605	the number of value levels that the device can provide in between maximum and minimum value.
Sensitivity 606	the minimum magnitude of input signal required to produce a specified output signal.
SNR 607	the ratio of a signal power to the noise power corrupting the signal
Accuracy 608	the degree of closeness of a measured quantity to its actual value
Position	the position of the device from the user's perspective according to the x-, y-, and z-axis

[0122] The source 630 may include a program representing the sensor capability base attributes using the XML.

[0123] A reference numeral 631 defines the maximum value 602 using the XML. According to the reference numeral 631, the maximum value 602 has "float" type data and is optionally used.

[0124] A reference numeral 632 defines the minimum value 603 using the XML. According to the reference numeral 632, the minimum value 603 has "float" type data and is optionally used.

[0125] A reference numeral 633 defines the numOflevels 605 using the XML. According to the reference numeral 633, the numOflevels 605 has "onNegativeInteger" type data and is optionally used.

[0126] However, the source 630 shown in FIG. 14 is not limiting but only example embodiments.

[0127] Table 3-2 shows a source of sensor capability base attributes according to other example embodiments.

[Table 3-2]

```

<!-- ##### -->
<!-- Definition of Sensor Capability Base Attributes -->
<!-- ##### -->
<attributeGroup name="SensorCapabilityBaseAttributes">
  <attribute name="unit" type="mpegvct:unitType" use="optional"/>
  <attribute name="maxValue" type="float" use="optional"/>
  <attribute name="minValue" type="float" use="optional"/>
  <attribute name="offset" type="float" use="optional"/>
  <attribute name="numOfLevels" type="nonNegativeInteger" use="optional"/>
  <attribute name="sensitivity" type="float" use="optional"/>
  <attribute name="SNR" type="float" use="optional"/>
</ attributeGroup>

```

[0128] Table 3-3 shows binary representation syntax corresponding to the sensor capability base attributes according to the example embodiments.

[Table 3-3]

SensorCapabilityBaseAttributesType {	Number of bits	Mnemonic
unitFlag	1	bslbf
maxValueFlag	1	bslbf
min ValueFlag	1	bslbf
offsetFlag	1	bslbf
numOfLevelsFlag	1	bslbf
sensitivityFlag	1	bslbf
SNRFlag	1	bslbf
if(unitFlag) {		
unit		unitType
}		
if(maxValueFlag) {		
max Value	32	fsbf
}		
if(minValueFlag) {		
minValue	32	fsbf
}		
if(offsetFlag) {		
offset	32	fsbf
}		
if(numOfLevelsFlag) {		
numOfLevels	32	uimsbf
}		

(continued)

SensorCapabilityBaseAttributesType {	Number of bits	Mnemonic
if(sensitivityFlag) {		
sensitivity	32	fsbf
}		
if(SNRFlag){		
SNR	32	fsbf
}		
}		

[0129] Table 3-4 shows descriptor components semantics of the sensor capability base attributes according to the example embodiments.

[Table 3-4]

Names	Description
SensorCapabilityBaseAttributesType	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
unitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxValueFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
minValueFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
offsetFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfLevelsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
sensitivityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SNRFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unit	Describes the unit of the sensor's measuring value. Specifies the unit of the sensor's measuring value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of Part 6 of ISO/IEC 23005, if a unit other than the default unit specified in the semantics of the maxVal and minVal is used for the values of maxVal and minVal are used.
maxValue	Describes the maximum value that the sensor can perceive. The terms will be different according to the individual sensor type.

(continued)

Names	Description
minValue	Describes the minimum value that the sensor can perceive. The terms will be different according to the individual sensor type.
offset	Describes the number of value locations added to a base value in order to get to a specific absolute value.
numOfLevels	Describes the number of value levels that the sensor can perceive in between maximum and minimum value. EXAMPLE The value 5 means the sensor can perceive 5 steps from minValue to maxValue.
sensitivity	Describes the minimum magnitude of input signal required to produce a specified output signal in given unit.
SNR	Describes the ratio of a signal power to the noise power corrupting the signal.

[0130] Referring back to FIG. 3A, the processing unit 320 may determine a first value received from the sensor based on the sensor capability, and transmit a second value corresponding to the first value to the virtual world.

[0131] Depending on embodiments, the processing unit 320 may transmit the second value that corresponds to the first value to the virtual world when the first value received from the sensor is less than or equal to a maximum value measurable by the sensor and greater than or equal to a minimum value measurable by the sensor.

[0132] The virtual world processing apparatus 300 may further include a second storage unit (not shown) to store sensor adaptation preference for manipulation of the first value received from the sensor. The processing unit 320 may generate a third value from the first value based on the sensor capability, and generate the second value from the third value based on the sensor adaptation preference.

[0133] Depending on embodiments, information on the motion, state, intention, shape, and the like of the user of the real world, which are measured through the sensor, may be directly reflected to the virtual world.

[0134] Hereinafter, the sensor capability will be described in relation to specific embodiments of the sensor. Although not limited to those embodiments, the sensor may include a position sensor, an orientation sensor, an acceleration sensor, a light sensor, a sound sensor, a temperature sensor, a humidity sensor, a distance sensor, a motion sensor, an intelligent camera sensor, an ambient noise sensor, an atmospheric sensor, a velocity sensor, an angular velocity sensor, an angular acceleration sensor, a force sensor, a torque sensor, and a pressure sensor.

[0135] Table 3-5 shows metadata encoding that classifies the sensors according to the example embodiments based on sensor types.

[Table 3-5]

Binary representation for sensor type	Term of Sensor
00000	Light sensor
00001	Ambient noise sensor
00010	Temperature sensor
00011	Humidity sensor
000100	Distance sensor
00101	Atmospheric sensor
00110	Position sensor
00111	Velocity sensor
01000	Acceleration sensor
01001	Orientation sensor
01010	Angular velocity sensor
01011	Angular acceleration sensor

(continued)

Binary representation for sensor type	Term of Sensor
01100	Force sensor
01101	Torque sensor
01110	Pressure sensor
01111	Motion sensor
10000	Intelligent camera sensor
10001-11111	Reserved

[0136] Table 4 shows sensor capability with respect to the position sensor using the XML. However, a program source shown in Table 4 is not limiting but only an example embodiment.

[Table 4]

```

<!-- ##### -->
<!-- Position Sensor capability type -->
<!-- ##### -->
<complexType name="PositionSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      <sequence>
        <element name="range"
          type="scdv:RangeType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="RangeType">
  <sequence>
    <element name="XminValue" type="float"/>
    <element name="XmaxValue" type="float"/>
    <element name="YminValue" type="float"/>
    <element name="YmaxValue" type="float"/>
    <element name="ZminValue" type="float"/>
    <element name="ZmaxValue" type="float"/>
  </sequence>
</complexType>

```

[0137] The position sensor capability type is a tool for describing sensor capability of the position sensor.

[0138] The position sensor capability type may include sensor capability base attributes of the position sensor.

[0139] The sensor capability base attributes of the position sensor may include a range, a range type, an x maximum value (xmaxValue), an x minimum value (xminValue), a y maximum value (ymaxValue), a y minimum value (yminValue), a z maximum value (zmaxValue), and a z minimum value (zminValue).

[0140] The range refers to a measurable range of the position sensor. For example, the measurable range of the position sensor may be indicated by a range type and a global coordinate system.

[0141] An origin of the global coordinate may be located at a top left corner. A right handed coordinate system may be applied to the global coordinate. In the global coordinate, a positive direction of an x-axis may be a direction to a top right corner of a screen, a positive direction of a y-axis may be a gravity direction, that is, a bottomward direction of the screen, and a positive direction of a z-axis may be a direction opposite to the user, that is, a direction into the screen.

[0142] The range type refers to a range of the global coordinate system according to the x-axis, the y-axis, and the z-axis.

[0143] The xmaxValue denotes a maximumvalue on the x-axis, measurable by the position sensor using a unit of a position coordinate, for example, meter.

[0144] The xminValue denotes a minimum value on the x-axis, measurable by the position sensor using a unit of a position coordinate, for example, meter.

[0145] The ymaxValue denotes a maximum value on the y-axis, measurable by the position sensor using a unit of a position coordinate, for example, meter.

[0146] The yminValue denotes a minimum value on the y-axis, measurable by the position sensor using a unit of a position coordinate, for example, meter.

[0147] The zmaxValue denotes a maximum value on the z-axis, measurable by the position sensor using a unit of a position coordinate, for example, meter.

[0148] The zminValue denotes a minimum value on the z-axis, measurable by the position sensor using a unit of a position coordinate, for example, meter.

[0149] Table 4-2 shows binary encoding syntax that converts the position sensor capability type from the XML format to the binary format.

[Table 4-2]

PositionSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
range		RangeType
}		
RangeType {		
XminValue	32	fsbf
XmaxValue	32	fsbf
YminValue	32	fsbf
YmaxValue	32	fsbf
ZminValue	32	fsbf
ZmaxValue	32	fsbf
}		

[0150] Table 4-3 shows descriptor components semantics of the position sensor capability type according to the example embodiments.

[Table 4-3]

Names	Description
PositionSensorCapabilityType	Tool for describing a position sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
range	Describes the range that the position sensor can perceive in terms of RangeType in its global coordinate system.
RangeType	Defines the range in a local coordinate system relative to the position of the sensor in idle state according to the x-, y-, and z-axis.
XminValue	Describes the minimum value that the position sensor can perceive along the x-axis in the unit of meter.
XmaxValue	Describes the maximum value that the position sensor can perceive along the x-axis in the unit of meter.
YminValue	Describes the minimum value that the position sensor can perceive along the y-axis in the unit of meter.
YmaxValue	Describes the maximum value that the position sensor can perceive along the y-axis in the unit of meter.
ZminValue	Describes the minimum value that the position sensor can perceive along the z-axis in the unit of meter.

(continued)

Names	Description
ZmaxValue	Describes the maximum value that the position sensor can perceive along the z-axis in the unit of meter.

[0151] Table 5 shows sensor capability with respect to the orientation sensor using the XML. However, a program source shown in Table 5 is not limiting but only an example embodiment.

[Table 5]

```

<!-- ##### -->
<!-- Orientation Sensor capability type -->
<!-- ##### -->
<complexType name="OrientationSensorCapabilityType">
  <complexContent>
    <extension base="scdv: SensorCapabilityBaseType">
      <sequence>
        <element name="OrientationRange"
          type="scdv:OrientationRangeType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="OrientationRangeType">
  <sequence>
    <element name="XMinRotation" type="float"/>
    <element name="XMaxRotation" type="float"/>
    <element name="YMinRotation" type="float"/>
    <element name="YMaxRotation" type="float"/>
    <element name="ZMinRotation" type="float"/>
    <element name="ZMaxRotation" type="float"/>
  </sequence>
</complexType>

```

[0152] The orientation sensor capability type is a tool for describing sensor capability of the orientation sensor.

[0153] The orientation sensor capability type may include sensor capability base attributes of the orientation sensor.

[0154] The sensor capability base attributes related to the orientation sensor may include an orientation range, an orientation range type, an x maximum value (xmaxValue), an x minimum value (xminValue), a y maximum value (ymaxValue), a y minimum value (yminValue), a z maximum value (zmaxValue), and a z minimum value (zminValue).

[0155] The range denotes a measurable range of the orientation sensor. For example, the measurable range of the orientation sensor may be indicated using the orientation range type and the global coordinate system.

[0156] The orientation range type denotes an orientation range of the global coordinate system according to the x-axis, the y-axis, and the z-axis.

[0157] The xmaxValue denotes a maximum value on the x-axis, measurable by the orientation sensor using a unit of an orientation coordinate, for example, radian.

[0158] The xminValue denotes a minimum value on the x-axis, measurable by the orientation sensor using a unit of an orientation coordinate, for example, radian.

[0159] The ymaxValue denotes a maximum value on the y-axis, measurable by the orientation sensor using a unit of an orientation coordinate, for example, radian.

[0160] The yminValue denotes a minimum value on the y-axis, measurable by the orientation sensor using a unit of an orientation coordinate, for example, radian.

[0161] The zmaxValue denotes a maximum value on the z-axis, measurable by the orientation sensor using a unit of an orientation coordinate, for example, radian.

[0162] The zminValue denotes a minimum value on the z-axis, measurable by the orientation sensor using a unit of an orientation coordinate, for example, radian.

[0163] Table 5-2 shows binary encoding syntax that converts the orientation sensor capability type from the XML format to the binary format.

[Table 5-2] ;

OrientationSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
OrientationRange		OrientationRangeType
}		
OrientationRangeType {		
YawMin	32	fsbf
YawMax	32	fsbf
PitchMin	32	fsbf
PitchMax	32	fsbf
RollMin	32	fsbf
RollMax	32	fsbf
}		

[0164] Table 5-3 shows descriptor components semantics of the orientation sensor capability type according to the example embodiments.

[Table 5-3]

Names	Description
OrientationSensorCapabilityType	Tool for describing an orientation sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
OrientationRange	Describes the range that the orientation sensor can perceive in terms of OrientationRangeType.
OrientationRangeType	Defines the range from the local coordinate system according to the Yaw, Pitch and Roll.
YawMin	Describes the minimum value that the orientation sensor can perceive for Yaw in the unit of degree.
YawMax	Describes the maximum value that the orientation sensor can perceive for Yaw in the unit of degree.
PitchMin	Describes the minimum value that the orientation sensor can perceive for Pitch in the unit of degree.
PitchMax	Describes the maximum value that the orientation sensor can perceive for Pitch in the unit of degree.
RollMin	Describes the minimum value that the orientation sensor can perceive for Roll in the unit of degree.
RollMax	Describes the maximum value that the orientation sensor can perceive for Roll in the unit of degree.

[0165] Table 6 shows sensor capability of an acceleration sensor using the XML. However, a program source shown in Table 5 is not limiting but only an example embodiment.

[Table 6]

```

<!-- ##### -->
<!-- Acceleration Sensor capability type -->
<!-- ##### -->
<complexType name="AccelerationSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
    </extension>
  </complexContent>
</complexType>

```

[0166] An acceleration sensor capability type is a tool for describing the sensor capability of the acceleration sensor.

[0167] The acceleration sensor capability type may include sensor capability base attributes of the acceleration sensor.

[0168] The sensor capability base attributes of the acceleration sensor may include a maximum value (maxValue) and a minimum value (minValue).

[0169] The max Value denotes a maximum value measurable by the acceleration sensor using a unit of acceleration, for example, m/s².

[0170] The min Value denotes a minimum value measurable by the acceleration sensor using a unit of acceleration, for example, m/s².

[0171] Table 6-2 shows binary encoding syntax that converts the orientation sensor capability type from the XML format to the binary format.

[Table 6-2]

AccelerationSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0172] Table 6-3 shows descriptor components semantics of the acceleration sensor capability type according to the example embodiments.

[Table 6-3]

Names	Description
AccelerationSensorCapabilityType	Tool for describing an acceleration sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia: TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0173] Table shows sensor capability of a light sensor using the XML. However, a program source shown in Table 7 is not limiting but only an example embodiment.

[Table 7]

```

<!-- ##### -->
<!-- Light Sensor capability type -->
<!-- ##### -->
<complexType name="LightSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      <sequence>
        <element name="color"
          type="scdv:colorType" minOccurs="0"
          maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

(continued)

```

        </sequence>
        <attribute name="location"
5          type="mpeg7:termReferenceType" use="optional"/>
      </extension>
    </complexContent>
  </complexType>

```

[0174] A light sensor capability type is a tool for describing the sensor capability of the light sensor.

[0175] The light sensor capability type may include sensor capability base attributes of the light sensor.

[0176] The sensor capability base attributes of the light sensor may include a maximum value (maxValue), a minimum value (minValue) a color, and a location.

[0177] The max Value denotes a maximum value measurable by the light sensor using a unit of light intensity, for example, LUX.

[0178] The minValue denotes a minimum value measurable by the light sensor using a unit of light intensity, for example, LUX.

[0179] The color denotes a color that may be provided by the light sensor. For example, the color may be an RGB color value.

[0180] The location denotes a location of the light sensor. For example, the location of the light sensor may be expressed using the global coordinate system according to the x-axis, the y-axis, and the z-axis.

[0181] Table 7-2 shows binary encoding syntax that converts the light sensor capability type from the XML format to the binary format.

[Table 7-2]

LightSensorCapabilityType {	Number of bits	Mnemonic
colorFlag	1	bslbf
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(colorFlag){		
Loopcolor		vluimsbf5
for(k=0;k<Loopcolor;k++){		
color[k]		ColorType
}		
}		
if(locationFlag){		
location		Float3DVectorType
}		
}		
Float3DVectorType {		
X	32	fsbf
Y	32	fsbf
Z	32	fsbf
}		

[0182] Table 7-3 shows descriptor components semantics of the light sensor capability type according to the example embodiments.

[Table 7-3]

Names	Description
LightSensorCapabilityType	Tool for describing a light sensor capability.
colorFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia: TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
Loopcolor	This field, which is only present in the binary representation, specifies the number of Color contained in the description.
color	Describes the list of colors which the lighting device can provide as a reference to a classification scheme term or as RGB value. A CS that may be used for this purpose is the ColorCS defined in A.2.3 of ISO/IEC 23005-6. EXAMPLE urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue would describe the color Alice blue.
location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).
Float3DVectorType	Tool for describing a 3D position vector
X	Describes the sensed value in x-axis in the unit.
Y	Describes the sensed value in y-axis in the unit.
Z	Describes the sensed value in z-axis in the unit.

[0183] Table 8 shows sensor capability related to a sound sensor using the XML. However, a program source shown in Table 8 is not limiting but only an example embodiment.

[Table 8]

```

<!-- ##### -->
<!-- Sound Sensor capability type -->
<!-- ##### -->
<complexType name="SoundSensorCapabilityType">
  <complexContent>
    <extension base="sidc:CapabilityBaseType"/>
  </complexContent>
</complexType>

```

[0184] A sound sensor capability type is a tool for describing the sensor capability of the sound sensor.

[0185] The sound sensor capability type may include sensor capability base attributes of the sound sensor.

[0186] The sensor capability base attributes of the sound sensor may include a max value (maxValue) and a minimum value (minValue).

[0187] The max Value denotes a maximum value measurable by the sound sensor using a unit of sound intensity, for example, decibel (dB).

[0188] The minValue denotes a minimum value measurable by the sound sensor using a unit of sound intensity, for example, dB.

[0189] Table 8-2 shows binary encoding syntax that converts the sound sensor capability type from the XML format to the binary format. !

[Table 8-2]

SoundSensorCapabilityType {	Number of bits	Mnemonic
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(locationFlag) {		
location		Float3DVectorType
}		
}		

[0190] Table 8-3 shows descriptor components semantics of the sound sensor capability type according to the example embodiments.

[Table 8-3]

Names	Description
SoundSensorCapabilityType	Tool for describing a sound sensor capability.
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

[0191] Table 9 shows sensor capability related to a temperature sensor using the XML. However, a program source shown in Table 9 is not limiting but only an example embodiment.

[Table 9]

```

<!-- ##### -->
<!-- Temperature Sensor capability type -->
<!-- ##### -->
<complexType name="TemperatureSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      <attribute name="location"
        type="mpeg7:termReferenceType" use="optional"/>
    </extension>
  </complexContent>
</complexType>!! ⤴

```

[0192] A temperature sensor capability type is a tool for describing the sensor capability of the temperature sensor.

[0193] The temperature sensor capability type may include sensor capability base attributes of the temperature sensor.

[0194] The sensor capability base attributes of the temperature sensor may include a maximum value (maxValue), a minimum value (minValue), and a location.

[0195] The maximum value denotes a maximum value measurable by the temperature sensor using a unit of temperature, for example, °C and °F.

[0196] The minimum value denotes a minimum value measurable by the temperature sensor using a unit of temperature, for example, °C and °F.

[0197] The location denotes a location of the temperature sensor. For example, the location of the temperature sensor may be expressed using the global coordinate system according to the x-axis, the y-axis, and the z-axis.

[0198] Table 9-2 shows binary encoding syntax that converts the temperature sensor capability type from the XML

format to the binary format.

[Table 9-2]

TemperatureSensorCapabilityType {	Number of bits	Mnemonic
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(locationFlag) {		
location		Float3DVectorType
}		
}		

[0199] Table 9-3 shows descriptor components semantics of the temperature sensor capability type according to the example embodiments.

[Table 9-3]

Names	Description
TemperatureSensorCapabilityType	Tool for describing a temperature sensor capability
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

[0200] Table 10 shows sensor capability related to a humidity sensor using the XML. However, a program source shown in Table 9 is not limiting but only an example embodiment.

[Table 10]

```

<!-- ##### -->
<!-- Humidity Sensor capability type -->
<!-- ##### -->
<complexType name="HumiditySensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      <attribute name="location"
        type="mpeg7:termReferenceType" use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0201] A humidity sensor type is a tool for describing the sensor adaptation preference of the humidity sensor.

[0202] A humidity sensor capability type may include sensor adaptation preference base attributes of the humidity sensor.

[0203] The sensor adaptation preference base attributes of the humidity sensor may include a maximum value (max-Value), a minimum value (min Value), and a location.

[0204] The max Value denotes a maximum value of a user preference related to humidity information measured by the humidity sensor.

[0205] The minValue denotes a minimum value of the user preference related to the humidity information measured by the humidity sensor.

[0206] The location denotes a location of the humidity sensor. For example, the location of the humidity sensor may be expressed using the global coordinate system according to the x-axis, the y-axis, and the z-axis.

[0207] Table 10-2 shows binary encoding syntax that converts the humidity sensor capability type from the XML format to the binary format.

[Table 10-2]

HumiditySensorCapabilityType {	Number of bits	Mnemonic
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(locationFlag){		
location		Float3DVectorType
}		
}		

[0208] Table 10-3 shows descriptor components semantics of the humidity sensor capability type according to the example embodiments.

[Table 10-3]

Names	Description
HumiditySensorCapabilityType	Tool for describing a humidity sensor capability.
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

[0209] Table 11 shows a sensor adaptation preference related to a distance sensor using the XML. However, a program source shown in Table 11 is not limiting but only an example embodiment.

[Table 11]

```

<!-- ##### -->
<!-- Distance Sensor capability type -->
<!-- ##### -->
<complexType name="DistanceSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      <attribute name="location"
        type="mpeg7:termReferenceType" use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0210] A distance sensor capability type is a tool or describing sensor capability of the distance sensor.

[0211] The distance sensor capability type may include sensor capability base attributes of the distance sensor.

[0212] The sensor capability base attributes of the distance sensor may include a maximum value (maxValue), a minimum value (minValue), and a location.

[0213] The max Value denotes a maximum value measurable by the distance sensor using a unit of length, for example, meter.

[0214] The minValue denotes a minimum value measurable by the distance sensor using a unit of length, for example, meter.

[0215] The location denotes a location of the distance sensor. For example, the location of the distance sensor may be expressed using the global coordinate system according to the x-axis, the y-axis, and the z-axis.

[0216] Table 11-2 shows binary encoding syntax that converts the distance sensor capability type from the XML format to the binary format.

[Table 11-2]

DistanceSensorCapabilityType {	Number of bits	Mnemonic
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(locationFlag){		
location		Float3DVectorType
}		
}		

[0217] Table 11-3 shows descriptor components semantics of the distance sensor capability type according to the example embodiments.

[Table 11-3]

Names	Description
DistanceSensorCapabilityType	Tool for describing a distance sensor capability.
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

[0218] Table 12 shows sensor capability related to a motion sensor using the XML. However, a program source shown in Table 12 is not limiting but only an example embodiment.

[Table 12]

```

<!-- ##### -->
<!-- Motion Sensor capability type -->
<!-- ##### -->
5 <complexType name="MotionSensorCapabilityType">
    <sequence>
        <element name="OrientationCapability"
            type="scdv:PositionSensorCapabilityType" minOccurs="0"/>
        <element name="OrientationCapability"
10 type="scdv:OrientationSensorCapabilityType" minOccurs="0"/>
        <element name="VelocityCapability"
            type="scdv:VelocitySensorCapabilityType" minOccurs="0"/>
        <element name="AngularVelocityCapability"
            type="scdv:AngularVelocitySensorCapabilityType" minOccurs="0"/>
        <element name="AccelerationCapability"
15 type="scdv:AccelerationSensorCapabilityType" minOccurs="0"/>
        <element name="AngularAccelerationCapability"
            type="scdv:AngularAccelerationSensorCapabilityType" minOccurs="0"/>
    </sequence>
</complexType>
20

```

[0219] A motion sensor capability type is a tool for describing the sensor capability of the motion sensor.

[0220] The motion sensor may be an integrated sensor of a plurality of sensors. For example, the motion sensor may integrally include a position sensor, a velocity sensor, an acceleration sensor, an orientation sensor, an angular velocity sensor, and an angular acceleration sensor.

[0221] The motion sensor capability type may include sensor capability base attributes of the motion sensor.

[0222] The sensor capability base attributes related to the motion sensor may include position capability, velocity capability, acceleration capability, orientation capability, angular velocity capability, and angular acceleration capability.

[0223] The position capability denotes capability with respect to the position.

[0224] The velocity capability denotes capability with respect to the velocity.

[0225] The acceleration capability denotes capability with respect to the acceleration.

[0226] The orientation capability denotes capability with respect to the orientation.

[0227] The angular velocity capability denotes capability with respect to the angular velocity.

[0228] The angular acceleration capability denotes capability with respect to the angular acceleration.

[0229] Table 12-2 shows binary encoding syntax that converts the motion sensor capability type from the XML format to the binary format.

[Table 12-2]

MotionSensorCapabilityType {	Number of bits	Mnemonic
PositionCapabilityFlag	1	bslbf
OrientationCapability Flag	1	bslbf
VelocityCapabilityFlag	1	bslbf
AngularVelocityCapabilityFlag	1	bslbf
AccelerationCapabilityFlag	1	bslbf
Angular AccelerationCapabilityFlag	1	bslbf
if(PositionCapabilityFlag){		
PositionCapability		PositionSensorCapabilityType
}		
if(OrientationCapabilityFlag){		
OrientationCapability		OrientationSensorCapabilityType
}		
if(VelocityCapabilityFlag) {		

(continued)

	MotionSensorCapabilityType {	Number of bits	Mnemonic
5	VelocityCapability		VelocitySensorCapabilityType
	}		
	if(AngularVelocityCapabilityFlag) {		
10	AngularVelocityCapability		Angular VelocitySensorCapabilityType
	}		
	if(AccelerationCapabilityFlag) {		
	AccelerationCapability		AccelerationSensorCapabilityType
15	}		
	if(AngularAccelerationCapabilityFlag){		
	Angular AccelerationCapability		AngularAccelerationSensorCapabilityType
	}		
20	}		

[0230] Table 12-3 shows descriptor components semantics of the motion sensor capability type according to the example embodiments.

[Table 12-3]

	Names	Description
	MotionSensorCapabilityType	Tool for describing a pressure sensor capability.
30	PositionCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
35	OrientationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
	VelocityCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
40	AngularVelocityCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
45	AccelerationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
	AngularAccelerationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
50	PositionCapability	Describes the capability with respect to the position as defined in PositionSensorCapabilityType.
	OrientationCapability	Describes the capability with respect to the orientation as defined in OrientationSensorCapabilityType.
55	Velocitycapability	Describes the capability with respect to the velocity as defined in VelocitySensorCapabilityType.

(continued)

Names	Description
Angular VelocityCapability	Describes the capability with respect to the angular as defined in AngularVelocitySensorCapabilityType.
AccelerationCapability	Describes the capability with respect to the acceleration as defined in AccelerationSensorCapabilityType.
AngularAccelerationCapability	Describes the capability with respect to the angular acceleration as defined in AngularAccelerationSensorCapabilityType.

[0231] Table 13 shows sensor capability of an intelligent camera sensor using the XML. However, a program source shown in Table 13 is not limiting but only an example embodiment.

[Table 13]

```
<!-- ##### -->
```

```
<!-- Intelligent Camera CapabilityType -->
```

<!-- ##### -->

<complexType name="IntelligentCameraCapabilityType">

<complexContent>

<extension base="scdv:SensorCapabilityBaseType">

<sequence>

<element name="FeatureTrackingStatus"

type="boolean" minOccurs="0"/>

<element

name="FacialExpressionTrackingStatus" type="boolean" minOccurs="0"/>

<element name="GestureTrackingStatus"

type="boolean" minOccurs="0"/>

<element

name="maxBodyFeaturePoint" type="nonNegativeInteger" minOccurs="0"/>

<element name="maxFaceFeaturePoint"

type="nonNegativeInteger" minOccurs="0"/>

<element name="TrackedFeature"

type="scdv:FeatureType" minOccurs="0"/>

<element name="TrackedFacialFeaturePoints"

type="scdv:FacialFeatureMask" minOccurs="0"/>

<element name="TrackedBodyFeaturePoints"

type="scdv:BodyFeatureMask" minOccurs="0"/>

</sequence>

</extension>

</complexContent>

</complexType>

<complexType name="FeatureType">

```

5      <sequence>
        <element name="Face" type="boolean"/>
        <element name="Body" type="boolean"/>
10     <element name="Both" type="boolean"/>
      </sequence>
    </complexType>
15  <complexType name="FacialFeatureMask">
    <sequence>
20      <element name="FaceFeaturePoint" type="boolean"
minOccurs="60" maxOccurs="200"/>
    </sequence>
25  </complexType>
    <complexType name="BodyFeatureMask">
30  <sequence>
        <element name="BodyFeaturePoint" type="boolean"
35  minOccurs="60" maxOccurs="200"/>
    </sequence>
40  </complexType>
    <!-- ##### -->
45  <!-- Intelligent Camera CapabilityType -->
    <!-- ##### -->
50  <complexType name="IntelligentCameraCapabilityType">
    <complexContent>
55  <extension base="cid:SensorCapabilityBaseType">

```

```

                    <sequence>
5                      <element      name="FeatureTrackingStatus"
                        type="boolean" minOccurs="0"/>
10                     <element
                        name="FacialExpressionTrackingStatus" type="boolean" minOccurs="0"/>
15                     <element      name="GestureTrackingStatus"
                        type="boolean" minOccurs="0"/>
                        <element
20                          name="maxBodyFeaturePoint" type="float" minOccurs="0"/>
                        <element      name="maxFaceFeaturePoint"
                            type="float" minOccurs="0"/>
25                     <element      name="TrackedFeature"
                            type="cid:FeatureType"/>
30                     <element name="TrackedFacialFeaturePoints"
                            type="cid:FacialFeatureMask"/>
35                     <element name="TrackedBodyFeaturePoints"
                            type="cid:BodyFeatureMask"/>
40                     </sequence>
                    </extension>
                    </complexContent>
45                </complexType>
                <complexType name="FeatureType">
50                    <sequence>
                        <element name="Face" type="boolean"/>
55                        <element name="Body" type="boolean"/>

```

```

                    <element name="Both" type="boolean"/>
5          </sequence>
        </complexType>
10    <complexType name="FacialFeatureMask">
        <sequence>
            <element name="FaceFeaturePoint" type="boolean"
15 minOccurs="60" maxOccurs="200"/>
        </sequence>
    </complexType>
20    <complexType name="BodyFeatureMask">
        <sequence>
            <element name="BodyFeaturePoint" type="boolean"
25 minOccurs="60" maxOccurs="200"/>
        </sequence>
    </complexType>
30
35

```

[0232] An intelligent camera sensor capability type is a tool for describing the sensor capability of the intelligent camera sensor.

[0233] The intelligent camera sensor capability type may include sensor capability base attributes of the intelligent camera sensor.

[0234] The sensor capability base attributes of the intelligent camera sensor may include a feature tracking status, an expression tracking status, a body movement tracking status, a maximum body feature point, a maximum face feature point, a tracked feature, tracked facial feature points, tracked body feature points, a feature type, a facial feature mask, and a body feature mask.

[0235] The feature tracking status denotes information on whether an intelligent camera sensor is capable of tracking features.

[0236] The expression tracking status denotes information on whether the intelligent camera sensor is capable of extracting animation related to a facial expression.

[0237] The body movement tracking status denotes information on whether the intelligent camera sensor is capable of extracting animation related to a body.

[0238] The maximum body feature point denotes a maximum value of a body feature that can be tracked by the intelligent camera sensor.

[0239] The maximum face feature point denotes a maximum value of a face feature that can be tracked by the intelligent camera sensor.

[0240] The tracked feature denotes information on whether tracking of the body feature and the face feature is possible.

[0241] The tracked facial feature points denote information on whether the respective face features are activated or based on the facial feature mask.

[0242] The tracked body feature points denote information on whether the respective body features are activated or based on the body feature mask.

[0243] The feature type denotes a list of feature types. For example, the feature type may include 1. Face, 2. Body, and 3. Face and body.

[0244] The facial feature mask denotes a list of facial features.

[0245] The body feature mask denotes a list of body features.

[0246] Table 13-2 shows binary encoding syntax that converts the intelligent camera sensor capability type from the XML format to the binary format.

[Table 13-2]

IntelligentCameraCapabilityType {	Number of bits	Mnemonic
FeatureTrackingStatusFlag	1	bslbf
FacialExpressionTrackingStatusFlag	1	bslbf
Gesture TrackingStatusFlag	1	bslbf
maxBodyFeaturePointFlag	1	bslbf
maxFaceFeaturePointFlag	1	bslbf
TrackedFeatureFlag	1	bslbf
TrackedFacialFeaturePointsFlag	1	bslbf
TrackedBodyFeaturePointsFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(FeatureTrackingStatusFlag) {		
FeatureTrackingStatus	1	bslbf
}		
if(FacialExpressionTrackingStatusFlag) {		
FacialExpressionTrackingStatus	1	bslbf
}		
if(GestureTrackingStatusFlag){		
GestureTrackingStatus	1	bslbf
}		
if(maxBodyFeaturePointFlag){		
maxBodyFeaturePoint	8	uimsbf
}		
if(maxFaceFeaturePointFlag) {		
maxFaceFeaturePoint	8	uimsbf
}		
if(TrackedFeatureFlag) {		
TrackedFeature	8	FeatureType
}		
if(TrackedFacialFeaturePointsFlag){		
TrackedFacialFeaturePoints	8	FacialFeatureMask
}		
if(TrackedBodyFeaturePointsFlag){		
TrackedBodyFeaturePoints	8	BodyFeatureMask

(continued)

	IntelligentCameraCapabilityType {	Number of bits	Mnemonic
5	}		
	}		
	FeatureType {		
	Face	1	bslbf
10	Body	1	bslbf
	Both	1	bslbf
	}		
15	FacialFeatureMask {		
	for(k=0;k< maxFaceFeaturePoint;k++){		
	FaceFeaturePoint[k]	1	bslbf
	}		
20	}		
	BodyFeatureMask {		
	for(k=0;k< maxBodyFeaturePoint;k++){		
25	BodyFeaturePoint[k]	1	bslbf
	}		
	}		

[0247] Table 13-3 shows descriptor components semantics of the intelligent camera sensor capability type according to the example embodiments.

[Table 13-3]

	Names	Description
35	IntelligentCameraCapabilityType	Tool for describing an intelligent camera capability.
	FeatureTrackingStatusFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
40	FacialExpressionTrackingStatusFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
45	GestureTrackingStatusFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
	maxBodyFeaturePointFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
50	maxFaceFeaturePointFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
55	TrackedFeatureFlag	This field, which is only present in the binary representation, signals the presence of the TrackedFeature element. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

(continued)

Names	Description
TrackedFacialFeaturePointsFlag	This field, which is only present in the binary representation, signals the presence of the TrackedFacialFeaturePoints element. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
TrackedBodyFeaturePointsFlag	This field, which is only present in the binary representation, signals the presence of the TrackedBodyFeaturePoints element. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
FeatureTrackingStatus	Describes whether the feature tracking is capable or not.
FacialExpressionTrackingStatus	Describes whether the intelligent camera can extract the facial animation or not.
GestureTrackingStatus	Describes whether the intelligent camera can extract the body animation or not.
maxBodyFeaturePoint	Describes the maximum number of body feature points that the intelligent camera can track.
maxFaceFeaturePoint	Describes the maximum number of facial feature points that the intelligent camera can track.
TrackedFeature	Describes what kind of feature points can be tracked as given in FeatureType, e.g., body, face or both.
TrackedFacialFeaturePoints	Describes whether each of the facial feature points orderly listed in 2.2.15 of ISO/IEC 23005-4 is active or not, based on FacialFeatureMask.
TrackedBodyFeaturePoints	Describes whether each of the body feature points orderly listed in 2.2.14 of ISO/IEC 23005-4 is active or not, based on BodyFeatureMask.
FeatureType	Describes a list of feature type (1. face, 2. body, and 3. both).
Face	Describes whether the intelligent camera can extract the face feature or not.
Body	Describes whether the intelligent camera can extract the body feature or not.
Both	Describes whether the intelligent camera can extract both (face and body) feature or not.
FacialFeatureMask	Provides a Boolean map of facial feature points in the order listed in 2.2.15 of ISO/IEC 23005-4 to identify active feature points.
FaceFeaturePoint	Describes whether each of the facial feature points can be activated or not. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
BodyFeatureMask	Provides a Boolean map of body feature points in the order listed in 2.2.14 of ISO/IEC 23005-4 to identify active feature points.
BodyFeaturePoint	Describes whether each of the body feature points can be activated or not. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

[0248] Table 14 shows sensor capability related to an ambient noise sensor using the XML. However, a program source shown in Table 14 is not limiting but only an example embodiment.

[Table 14]

```

<!-- ##### -->
<!-- Ambient noise Sensor capability type -->
<!-- ##### -->
<complexType name="AmbientNoiseSensorCapabilityType">
  <complexContent>
    <extension base="scdv: SensorCapabilityBaseType">
      <attribute name="location"
        type="mpeg7:termReferenceType" use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0249] An ambient noise sensor capability type is a tool for describing the sensor capability related to the ambient noise sensor.

[0250] The ambient noise sensor capability type may include sensor capability base attributes related to the ambient noise sensor.

[0251] The sensor capability base attributes related to the ambient noise sensor may include a maximum value, a minimum value, and a location.

[0252] The maximum value denotes a maximum value measurable by the ambient noise sensor. For example, a unit for the ambient noise sensor may be dB.

[0253] The minimum value denotes a minimum value measurable by the ambient noise sensor. For example, a unit for the ambient noise sensor may be dB.

[0254] The location denotes a location of the ambient noise sensor. For example, the location of the ambient noise sensor may be expressed using the global coordinate according to the x-axis, the y-axis, and the z-axis.

[0255] Table 14-2 shows binary encoding syntax that converts the ambient noise sensor capability type from the XML format to the binary format.

[Table 14-2]

AmbientNoiseSensorCapabilityType {	Number of bits	Mnemonic
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(locationFlag){		
location		Float3DVectorType
}		
}		

[0256] Table 14-3 shows descriptor components semantics of the ambient noise sensor capability type according to the example embodiments.

[Table 14-3]

Names	Description
AmbientNoiseSensorCapabilityType	Tool for describing an ambient noise sensor capability.
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
Location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

[0257] Table 15 denotes sensor capability related to an atmospheric pressure sensor using the XML. However, a program source shown in Table 15 is not limiting but only an example embodiment.

[Table 15]

```

5      <!-- ##### -->
      <!-- Atmospheric Pressure Sensor capability type
      -->
      <!-- ##### -->
      <complexType name="AtmosphericPressureSensorCapabilityType">
10          <complexContent>
              <extension base="scdv: SensorCapabilityBaseType">
                  <attribute name="location"
                      type="mpeg7:termReferenceType" use="optional"/>
              </extension>
          </complexContent>
15      </complexType>

```

[0258] An atmospheric pressure sensor capability type is a tool for describing the sensor capability of the atmospheric pressure sensor.

[0259] The atmospheric pressure sensor capability type may include sensor capability base attributes of the atmospheric pressure sensor.

[0260] The atmospheric pressure capability base attributes of the atmospheric pressure sensor may include a maximum value (maxValue), a minimum value (minValue), and a location.

[0261] The maxValue denotes a maximum value measurable by the atmospheric pressure sensor using a unit of atmospheric pressure, for example, hectopascal (hPa).

[0262] The minValue denotes a minimum value measurable by the atmospheric pressure sensor using a unit of atmospheric pressure, for example, hPa.

[0263] The location denotes a location of the atmospheric pressure sensor. For example, the location of the atmospheric pressure sensor may be expressed using the global coordinate according to the x-axis, the y-axis, and the z-axis.

[0264] Table 15-2 shows binary encoding syntax that converts the atmospheric pressure sensor capability type from the XML format to the binary format.

[Table 15-2]

AtmosphericPressureSensorCapabilityType {	Number of bits	Mnemonic
locationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(locationFlag) {		
location		Float3DVectorType
}		
}		

[0265] Table 15-3 shows descriptor components semantics of the atmospheric pressure sensor capability type according to the example embodiments.

[Table 15-3]

Names	Description
AtmosphericPressureSensorCapabilityType	Tool for describing an atmospheric pressure sensor capability.
locationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

(continued)

Names	Description
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.
location	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

[0266] Table 16 shows sensor capability related to a velocity sensor using the XML. However, a program source shown in Table 16 is not limiting but only an example embodiment.

[Table 16]

```

<!-- ##### -->
<!-- Velocity Sensor capability type -->
<!-- ##### -->
<complexType name="VelocitySensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
    </extension>
  </complexContent>
</complexType>

```

[0267] A velocity sensor capability type is a tool for describing the sensor capability of the velocity sensor.

[0268] The velocity sensor capability type may include sensor capability base attributes of the velocity sensor.

[0269] The velocity capability base attributes of the velocity sensor may include a maximum value (maxValue) and a minimum value (minValue).

[0270] The maxValue denotes a maximum value measurable by the velocity sensor using a unit of velocity, for example, m/s.

[0271] The minValue denotes a minimum value measurable by the velocity sensor using a unit of velocity, for example, m/s.

[0272] Table 16-2 shows binary encoding syntax that converts the velocity sensor capability type from the XML format to the binary format.

[Table 16-2]

VelocitySensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0273] Table 16-3 shows descriptor components semantics of the velocity sensor capability type according to the example embodiments.

[Table 16-3]

Names	Description
VelocitySensorCapabilityType	Tool for describing a velocity sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0274] Table 17 shows sensor capability related to an angular velocity sensor using the XML. However, a program

source shown in Table 17 is not limiting but only an example embodiment.

[Table 17]

```

5      <!-- ##### -->
      <!-- Angular Velocity Sensor capability type --
      >
      <!-- ##### -->
      <complexType name="AngularVelocitySensorCapabilityType">
          <complexContent>
10              <extension base="scdv: SensorCapabilityBaseType">
                  </extension>
              </complexContent>
          </complexType>

```

[0275] An angular velocity sensor capability type is a tool for describing the sensor capability related to the angular velocity sensor.

[0276] The angular velocity sensor capability type may include sensor capability base attributes related to the angular velocity sensor.

[0277] The angular velocity capability base attributes related to the angular velocity sensor may include a maximum value (maxValue) and a minimum value (minValue).

[0278] The max Value denotes a maximum value measurable by the angular velocity sensor using a unit of angular velocity, for example, radian/s.

[0279] The minValue denotes a minimum value measurable by the angular velocity sensor using a unit of angular velocity, for example, radian/s.

[0280] Table 17-2 shows binary encoding syntax that converts the angular velocity sensor capability type from the XML format to the binary format.

[Table 17-2]

AngularVelocitySensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0281] Table 17-3 shows descriptor components semantics of the angular velocity sensor capability type according to the example embodiments.

[Table 17-3]

Names	Description
AngularVelocitySensorCapabilityType	Tool for describing an angular velocity sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0282] Table 18 shows sensor capability related to an angular acceleration sensor using the XML. However, a program source shown in Table 18 is not limiting but only an example embodiment.

[Table 18]

```

<!-- ##### -->
<!-- Angular Acceleration Sensor capability type
-->
<!-- ##### -->
<complexType name="AngularAccelerationSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      </extension>
    </complexContent>
  </complexType>

```

[0283] An angular acceleration sensor capability type is a tool for describing the sensor capability related to the angular acceleration sensor.

[0284] The angular acceleration sensor capability type may include sensor capability base attributes related to the angular acceleration sensor.

[0285] The angular acceleration capability base attributes related to the angular acceleration sensor may include a maximum value (maxValue) and a minimum value (minValue).

[0286] The max Value denotes a maximum value measurable by the angular acceleration sensor using a unit of angular acceleration, for example, radian/s².

[0287] The min Value denotes a minimum value measurable by the angular acceleration sensor using a unit of angular acceleration, for example, radian/s².

[0288] Table 18-2 shows binary encoding syntax that converts the angular acceleration sensor capability type from the XML format to the binary format.

[Table 18-2]

AngularAccelerationSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0289] Table 18-3 shows descriptor components semantics of the angular acceleration sensor capability type according to the example embodiments.

[Table 18-3]

Names	Description
AngularAccelerationSensorCapabilityType	Tool for describing an angular acceleration sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0290] Table 19 denotes sensor capability related to a force sensor type using the XML. However, a program source shown in Table 19 is not limiting but only an example embodiment.

[Table 19]

```

<!-- ##### -->
<!-- Force Sensor capability type -->
<!-- ##### -->
<complexType name="ForceSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
      </extension>
    </complexContent>
  </complexType>

```

[0291] A force sensor capability type is a tool for describing the sensor capability related to the force sensor.

[0292] The force sensor capability type may include sensor capability base attributes related to the force sensor.

[0293] The force capability base attributes related to the force sensor may include a maximum value (maxValue) and a minimum value (minValue).

[0294] The max Value denotes a maximum value measurable by the force sensor using a unit of force, for example, Newton (N).

[0295] The min Value denotes a minimum value measurable by the force sensor using a unit of force, for example, N.

[0296] Table 19-2 shows binary encoding syntax that converts the force sensor capability type from the XML format to the binary format.

[Table 19-2]

ForceSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0297] Table 19-3 shows descriptor components semantics of the force sensor capability type according to the example embodiments.

[Table 19-3]

Names	Description
ForceSensorCapabilityType	Tool for describing a force sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia: TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0298] Table 20 denotes a sensor adaptation preference related to a torque sensor type using the XML. However, a program source shown in Table 20 is not limiting but only an example embodiment.

[Table 20]

```

<!-- ##### -->
<!-- Torque Sensor capability type -->
<!-- ##### -->
<complexType name="TorqueSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
    </extension>
  </complexContent>
</complexType>

```

[0299] A torque sensor capability type is a tool for describing the sensor capability related to the torque sensor.

[0300] The torque sensor capability type may include sensor capability base attributes related to the torque sensor.

[0301] The torque capability base attributes related to the torque sensor may include a maximum value (maxValue), a minimum value (minValue), and a location.

[0302] The max Value denotes a maximum value measurable by the torque sensor using a unit of torque, for example, Newton millimeter (N-mm).

[0303] The min Value denotes a minimum value measurable by the torque sensor using a unit of torque, for example, N-mm.

[0304] Table 20-2 shows binary encoding syntax that converts the torque sensor capability type from the XML format to the binary format.

[Table 20-2]

TorqueSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0305] Table 20-3 shows descriptor components semantics of the torque sensor capability type according to the example embodiments.

[Table 20-3]

Names	Description
TorqueSensorCapabilityType	Tool for describing a torque sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0306] Table 21 shows sensor capability related to a pressure sensor using the XML. However, a program source shown in Table 21 is not limiting but only an example embodiment.

[Table 21]

```

<!-- ##### -->
<!-- Pressure Sensor capability type -->
<!-- ##### -->
<complexType name="PressureSensorCapabilityType">
  <complexContent>
    <extension base="scdv:SensorCapabilityBaseType">
    </extension>
  </complexContent>
</complexType>

```

[0307] A pressure sensor capability type is a tool for describing the sensor capability related to the pressure sensor.

[0308] The pressure sensor capability type may include sensor capability base attributes related to the pressure sensor.

[0309] The pressure capability base attributes related to the pressure sensor may include a maximum value (maxValue), a minimum value (minValue), and a location.

[0310] The max Value denotes a maximum value measurable by the pressure sensor using a unit of pressure, for example, m/s.

[0311] The minValue denotes a minimum value measurable by the pressure sensor using a unit of pressure, for example, m/s.

[0312] Table 21-2 shows binary encoding syntax that converts the pressure sensor capability type from the XML format to the binary format.

[Table 21-2]

PressureSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

[0313] Table 21-3 shows descriptor components semantics of the pressure sensor capability type according to the example embodiments.

[Table 21-3]

Names	Description
PressureSensorCapabilityType	Tool for describing a pressure sensor capability.
SensorCapabilityBase	SensorCapabilityBaseType extends dia:TerminalCapabilityBaseType and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types. For details of dia:TerminalCapabilityBaseType, refer to the Part 7 of ISO/IEC 21000.

[0314] Hereinafter, the sensor adaptation preference will be described in detail.

[0315] The sensor adaptation preference denotes information for manipulating a value received from a sensor.

[0316] A sensor adaptation preference base type denotes a base type of manipulation information of the user. Depending on embodiments, the sensor adaptation preference base type may be a base abstract type of the metadata related to a sensor adaptation preference commonly applied to all types of sensors, as part of metadata types related to the sensor adaptation preference.

[0317] Hereinafter, the sensor adaptation preference and the sensor adaptation preference base type will be described in detail with reference to FIGS. 15 through 17.

[0318] FIG. 15 illustrates a sensor adaptation preference base type 700 according to example embodiments.

[0319] Referring to FIG. 15, the sensor adaptation preference base type 700 may include sensor adaptation preference base attributes 710 and any attributes 720.

[0320] The sensor adaptation preference base attributes 710 denote a group of sensor adaptation preferences basically included in the sensor adaptation preference base type 700.

[0321] The any attributes 720 denote a group of additional sensor adaptation preferences. The any attributes 720 may be unique additional sensor capabilities which are applicable to an arbitrary sensor. The any attributes 720 may allow for the inclusion of any attributes defined within a namespace other than the target namespace.

[0322] FIG. 16 illustrates syntax 800 of a sensor adaptation preference base type according to example embodiments.

[0323] Referring to FIG. 16, the syntax of the sensor adaptation preference base type may include a diagram 810, attributes 820, and a source 830.

[0324] The diagram 810 may include a diagram of the sensor adaptation preference base type.

[0325] The attributes 820 may include sensor adaptation preference base attributes and any attributes.

[0326] The source 830 may be a program representing the sensor adaptation preference base type using an XML. However, the source 830 shown in FIG. 16 is suggested by way of example but not limiting.

[0327] FIG. 17 illustrates syntax 900 of sensor adaptation preference base attributes according to example embodiments.

[0328] Referring to FIG. 17, the syntax 900 of the sensor adaptation preference base attributes may include a diagram 910, attributes 920, and a source 930.

[0329] The diagram 910 may include a diagram of the sensor adaptation preference base attributes.

[0330] The attributes 920 may include a sensor reference identifier (ID) 901, a sensor adaptation mode 902, an activation state 903, a unit 904, a maximum value 905, a minimum value 906, and a number of levels 907.

[0331] The sensor reference ID 901 denotes information referencing an ID of an individual sensor that generates specific sensed information.

[0332] The sensor adaptation mode 902 denotes user preference information related to a method of adapting a sensor. Depending on embodiments, the sensor adaptation mode 902 may be a sensor adaptation preference related to an adaptation method that refines information on a motion, state, intention, shape, and the like of a user of a real world, measured through the sensor, and reflects the information to a virtual world. For example, a 'strict' value may denote a user preference that directly applies sensed information of the real world to the virtual world. A 'scalable' value may denote a user preference that varies the sensed information of the real world according to the user preference and applies the sensed information to the virtual world.

[0333] The activation state information 903 denotes information on whether to activate the sensor in the virtual world. Depending on embodiments, the activation state information 903 may be a sensor adaptation preference that determines whether the sensor is in operation.

[0334] The unit 904 denotes a unit of a value used in the virtual world. For example, the unit 904 may be a pixel. Also, the unit 904 may be a unit of a value corresponding to the value received from the sensor.

[0335] The maximum value 905 and the minimum value 906 denote a maximum value and a minimum value used in the virtual world, respectively. Depending on embodiments, the maximum value 905 and the minimum value 906 may be the unit of the value corresponding to the value received from the sensor.

[0336] The number of levels 907 denotes a number of levels used in the virtual world. Depending on embodiments, the number of levels 907 may be a value for dividing levels between the maximum value and the minimum used in the virtual world.

[0337] The sensor reference ID 901, the adaptation mode 902, the activation state 903, the unit 904, the maximum value 905, the minimum value 906, and the number of levels 907, as the sensor adaptation preference base attributes, may be rearranged as shown in Table 22.

[Table 22]

Name	Definition
SensorIdRef 901	Refers the Id of an individual sensor that has generated the specific sensed information
Sensor adaptation mode 902	the user's preference on the adaptation method for the virtual world effect
Activate 903	whether the effect shall be activated. a value of true means the effect shall be activated and false means the effect shall be deactivated
Unit 904	the unit of value
maxValue 905	the maximum desirable value of the effect in percentage according to the max scale defined within the semantics definition of the individual effects
minValue 906	the minimum desirable value of the effect in percentage according to the min scale defined within the semantics definition of the individual effects
numOflevels 907	the number of value levels that the device can provide in between maximum and minimum value

[0338] The source 930 may be a program representing the sensor adaptation preference base attributes using the XML.

[0339] A reference numeral 931 defines the activation state 903 using the XML. According to the reference numeral 931, the activation state 903 has "boolean" type data and is optionally used.

[0340] A reference numeral 932 defines the maximum value 905 using the XML. According to the reference numeral 932, the maximum value 905 has "float" type data and is optionally used.

[0341] A reference number 933 defines minimum value 906 using the XML. According to the reference numeral 933, the minimum value 906 has "float" type data and is optionally used.

[0342] A reference numeral 934 defines the number of levels 907 using the XML. According to the reference numeral 934, the number of levels 907 has "nonNegativeInteger" type data and is optionally used.

[0343] However, the source 930 illustrated in FIG. 17 is not limiting but only example embodiments.

[0344] Hereinafter, the sensor adaptation preference will be described in relation to specific embodiments of the sensor.

[0345] Table 23 denotes a sensor adaptation preference related to a position sensor using the XML. However, a program source shown in Table 23 is not limiting but only an example embodiment.

[Table 23]

```

<!-- ##### -->
<!--Position Sensor Preference type -->
<!-- ##### -->
<complexType name="PositionSensorPrefType">
  <complexContent>
    <extension base="scdv: SensorCapabilityBaseType">
      <sequence>
        <element name="range"
          type="scdv:RangeType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

[0346] A position sensor type is a tool for describing the sensor adaptation preference related to the position sensor.

[0347] A position sensor capability type may include sensor adaptation preference base attributes related to the position sensor.

[0348] The sensor adaptation preference base attributes related to the position sensor may include a range and a number of levels.

[0349] The range denotes a range of a user preference with respect to position information measured by the position sensor.

[0350] The number of levels denotes a number of levels of the user preference with respect to the position information measured by the position sensor.

[0351] Table 24 denotes a sensor adaptation preference related to an orientation sensor using the XML. However, a program source shown in Table 24 is not limiting but only an example embodiment.

[Table 24]

```

<!-- ##### -->
<!-- Orientation Sensor Preference type -->
<!-- ##### -->
<complexType name="OrientationSensorPrefType">
  <complexContent>
    <extension base=cid: SensorCapabilityBaseType/>
    <sequence>
      <element name="orientationrange"
        type="scdv:OrientationRangeType"/>
    </sequence>
  </extension>
</complexContent>
</complexType>

```

[0352] An orientation sensor type is a tool for describing the sensor adaptation preference related to the orientation sensor.

[0353] An orientation sensor capability type may include sensor adaptation preference base attributes related to the orientation sensor.

[0354] The sensor adaptation preference base attributes related to the orientation sensor may include an orientation range and a number of levels.

[0355] The orientation range denotes a range of a user preference with respect to orientation information measured by the orientation sensor.

[0356] The number of levels denotes a number of levels of the user preference with respect to the orientation information measured by the orientation sensor.

[0357] Table 25 denotes a sensor adaptation preference related to an acceleration sensor using the XML. However, a program source shown in Table 25 is not limiting but only an example embodiment.

[Table 25]

```

<!-- ##### -->
<!-- Acceleration Sensor Preference type -->
<!-- ##### -->
<complexType name="AccelerationSensorPrefType">
  <complexContent>
    <extension base=cid: SensorCapabilityBaseType/>
  </complexContent>
</complexType>

```

[0358] An acceleration sensor type is a tool for describing the sensor adaptation preference related to the acceleration sensor.

[0359] An acceleration sensor capability type may include sensor adaptation preference base attributes related to the acceleration sensor.

[0360] The sensor adaptation preference base attributes related to the acceleration sensor may include a maximum value, a minimum value, and a number of levels.

[0361] The maximum value denotes a maximum value of a user preference related to acceleration information measured by the acceleration sensor.

[0362] The minimum value denotes a minimum value of the user preference related to the acceleration information measured by the acceleration sensor.

[0363] The number of levels denotes a number of levels of the user preference with respect to the acceleration

information measured by the acceleration sensor.

[0364] Table 26 denotes a sensor adaptation preference related to a light sensor using the XML. However, a program source shown in Table 26 is not limiting but only an example embodiment.

[Table 26]

```

<!-- ##### -->
<!-- Light Sensor Preference type -->
<!-- ##### -->
<complexType name="LightSensorPrefType">
  <complexContent>
    <extension base="scdv:UserSensorPreferenceBaseType">
      <sequence>
        <element name="color"
          type="scdv:colorType" minOccurs="0"
maxOccurs="unbounded" />
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

[0365] A light sensor type is a tool for describing the sensor adaptation preference related to the light sensor.

[0366] A light sensor capability type may include sensor adaptation preference base attributes related to the light sensor.

[0367] The sensor adaptation preference base attributes related to the light sensor may include a maximum value, a minimum value, a number of levels, and an unfavorable color.

[0368] The maximum value denotes a maximum value of a user preference related to a value measured by the light sensor.

[0369] The minimum value denotes a minimum value of the user preference related to a value measured by the light sensor.

[0370] The number of levels denotes a number of levels of the user preference with respect to a value measured by the light sensor.

[0371] The unfavorable color denotes a list of unfavorable colors of the user, as RGB color values or a classification reference.

[0372] Table 27 denotes a sensor adaptation preference related to a sound sensor using the XML. However, a program source shown in Table 27 is not limiting but only an example embodiment.

[Table 27]

```

<!-- ##### -->
<!-- USIPV Sound Sensor type -->
<!-- ##### -->
<complexType name="SoundSensorType">
  <complexContent>
    <extension base="usip:PreferenceBaseType"/>
  </complexContent>
</complexType>

```

[0373] A sound sensor type is a tool for describing the sensor adaptation preference related to the sound sensor.

[0374] A sound sensor capability type may include sensor adaptation preference base attributes related to the sound sensor.

[0375] The sensor adaptation preference base attributes related to the sound sensor may include a maximum value and a minimum value.

[0376] The maximum value denotes a maximum value allowed by the user as a measured value of the sound sensor.

[0377] The minimum value denotes a minimum value allowed by the user as a measured value of the sound sensor.

[0378] Table 28 denotes a sensor adaptation preference related to a temperature sensor using the XML. However, a program source shown in Table 28 is not limiting but only an example embodiment.

[Table 28]

```
##### -->
<!-- Temperature Sensor Preference type -->
<!-- ##### -->
5 <complexType name="TemperatureSensorPrefType">
    <complexContent>
        <extension base="scdv:UserSensorPreferenceBaseType"/>
    </complexContent>
</complexType>
```

[0379] A temperature sensor type is a tool for describing the sensor adaptation preference related to the temperature sensor.

[0380] A temperature sensor capability type may include sensor adaptation preference base attributes related to the temperature sensor.

[0381] The sensor adaptation preference base attributes related to the temperature sensor may include a maximum value, a minimum value, and a number of levels.

[0382] The maximum value denotes a maximum value of a user preference related to temperature information measured by the temperature sensor.

[0383] The minimum value denotes a minimum value of the user preference related to the temperature information measured by the temperature sensor.

[0384] The number of levels denotes a number of levels of the user preference with respect to the temperature information measured by the temperature sensor.

[0385] Table 29 denotes a sensor adaptation preference related to a humidity sensor using the XML. However, a program source shown in Table 29 is not limiting but only an example embodiment.

[Table 29]

```
<!-- ##### -->
<!-- Humidity Sensor Preference type -->
<!-- ##### -->
30 <complexType name="HumiditySensorPrefType">
    <complexContent>
        <extension base="scdv:UserSensorPreferenceBaseType"/>
    </complexContent>
</complexType>
```

[0386] A humidity sensor type is a tool for describing the sensor adaptation preference related to the humidity sensor.

[0387] A humidity sensor capability type may include sensor adaptation preference base attributes related to the humidity sensor.

[0388] The sensor adaptation preference base attributes related to the humidity sensor may include a maximum value, a minimum value, and a number of levels.

[0389] The maximum value denotes a maximum value of a user preference related to humidity information measured by the humidity sensor.

[0390] The minimum value denotes a minimum value of the user preference related to the humidity information measured by the humidity sensor.

[0391] The number of levels denotes a number of levels of the user preference with respect to the humidity information measured by the humidity sensor.

[0392] Table 30 denotes a sensor adaptation preference related to a distance sensor using the XML. However, a program source shown in Table 30 is not limiting but only an example embodiment.

[Table 30]

```
<!-- ##### -->
<!-- Distance Sensor Preference type -->
<!-- ##### -->
50 <complexType name="DistanceSensorPrefType">
    <complexContent>
        <extension base="scdv:UserSensorPreferenceBaseType"/>
    </complexContent>
</complexType>
```

[0393] A distance sensor type is a tool for describing the sensor adaptation preference related to the distance sensor.

[0394] A distance sensor capability type may include sensor adaptation preference base attributes related to the distance sensor.

[0395] The sensor adaptation preference base attributes related to the distance sensor may include a maximum value, a minimum value, and a number of levels.

[0396] The maximum value denotes a maximum value of a user preference related to length information measured by the distance sensor.

[0397] The minimum value denotes a minimum value of the user preference related to the length information measured by the distance sensor.

[0398] The number of levels denotes a number of levels of the user preference with respect to the length information measured by the distance sensor.

[0399] Table 31 denotes a sensor adaptation preference related to a motion sensor using the XML. However, a program source shown in Table 31 is not limiting but only an example embodiment.

[Table 31]

```

<!-- ##### -->
<!-- Motion Sensor Preference type -->
<!-- ##### -->
    <complexType name="MotionSensorPrefType">
        <sequence>
            <element name="positionpreference"
                type="scdv:PositionSensorPrefType" minOccurs="0"/>
            <element name="orientationpreference"
                type="scdv:OrientationSensorPrefType" minOccurs="0"/>
            <element name="velocitypreference"
                type="scdv:VelocitySensorPrefType" minOccurs="0"/>
            <element name="angularvelocitypreference"
                type="scdv:AngularVelocitySensorPrefType" minOccurs="0"/>
            <element name="accelerationpreference"
                type="scdv:AccelerationSensorPrefType" minOccurs="0"/>
            <element name="angularaccelerationpreference"
                type="scdv:AngularAccelerationSensorPrefType" minOccurs="0"/>
        </sequence>
    </complexType>

```

[0400] A motion sensor capability type is a tool for describing the sensor adaptation preference related to the motion sensor.

[0401] The motion sensor capability type may include sensor adaptation preference base attributes related to the motion sensor.

[0402] The sensor adaptation preference base attributes related to the motion sensor may include a position preference, a velocity preference, an acceleration preference, an orientation preference, an angular velocity preference, and an angular acceleration preference.

[0403] The position preference denotes a user preference with respect to the position.

[0404] The velocity preference denotes a user preference with respect to the velocity.

[0405] The acceleration preference denotes a user preference with respect to the acceleration.

[0406] The orientation preference denotes a user preference with respect to the orientation.

[0407] The angular velocity preference denotes a user preference with respect to the angular velocity.

[0408] The angular acceleration preference denotes a user preference with respect to the angular acceleration.

[0409] Table 32 denotes a sensor adaptation preference related to an intelligent camera sensor using the XML. However, a program source shown in Table 32 is not limiting but only an example embodiment.

[Table 32]

```

5      <!-- ##### -->
      <!--      intelligent      Camera      Preference      Type
-->
10     <!-- ##### -->

      <complexType name="IntelligentCameraPreferenceType">
15         <complexContent>
            <extension
20 base="scdv:SensorAdaptationPreferenceBaseType">
                <sequence>
25                     <element      name="FaceFeatureTrackingOn"
type="boolean" minOccurs="0"/>
30                     <element      name="BodyFeatureTrackingOn"
type="boolean" minOccurs="0"/>
35                     <element

```

```
name="FacialExpressionTrackingOn" type="boolean" minOccurs="0"/>
```

```
<element name="GestureTrackingOn"
```

```
type="boolean" minOccurs="0"/>
```

<element name="FacialFeatureMask"

```
type="scdv:FacialFeatureMaskType"/>
```

```
<element name="BodyFeatureMask"
```

type="scdv:BodyFeatureMaskType"/>

</sequence>

</extension>

</complexContent>

</complexType>

<complexType name="FacialFeatureMaskType">

<sequence>

```
<element name="Eyes" type="boolean"/>
```

```
<element name="Mouth" type="boolean"/>
```

<element name="Nose" type="boolean"/>

<element name="Ears" type="boolean"/>

</sequence>

</complexType>

```
<complexType name="BodyFeatureMaskType">
```

<sequence>

```
<element name="Head" type="boolean"/>
```

```
<element name="Arms" type="boolean"/>
```

<element name="Hands" type="boolean"/>

<element name="Legs" type="boolean"/>

<element name="Feet" type="boolean"/>

<element name="MiddleBody" type="boolean"/>

</sequence>

</complexType>

[0410] An intelligent camera sensor capability type is a tool for describing the sensor adaptation preference related to the intelligent camera sensor.

[0411] The intelligent camera sensor capability type may include sensor adaptation preference base attributes related to the intelligent camera sensor.

[0412] The sensor adaptation preference base attributes related to the intelligent camera sensor may include a face feature tracking on, a body feature tracking on, a facial expression tracking on, a gesture tracking on, a face tracking map, and a body tracking map.

[0413] The face feature tracking on denotes information on whether to activate a face feature tracking mode in which an intelligent camera sensor tracks features on a face of the user.

[0414] The body feature tracking on denotes information on whether to activate a body feature tracking mode in which the intelligent camera sensor tracks features on a body of the user.

[0415] The facial expression tracking on denotes information on user preference with respect to tracking of a facial expression of the user by the intelligent camera sensor.

[0416] The gesture tracking on denotes information on user preference with respect to tracking of a gesture of the user by the intelligent camera sensor.

[0417] The face tracking map provides a Boolean map related to a face tracking map type. The Boolean map provides face portions that the user wants to track. Depending on embodiments, the Boolean map according to the face tracking map type may provide eyes, a mouth, a nose, and ears as the face portions.

[0418] The body tracking map provides a Boolean map related to a body tracking map type. The Boolean map provides body portions that the user wants to track. Depending on embodiments, the Boolean map according to the body tracking map type may provide a head, arms, hands, legs, feet, and a middle body as the body portions.

[0419] Table 33 denotes a sensor adaptation preference related to an ambient noise sensor using the XML. However, a program source shown in Table 33 is not limiting but only an example embodiment.

[Table 33]

```
<!-- ##### -->
<!-- Ambient Noise Sensor Preference type -->
<!-- ##### -->
<complexType name="AmbientNoiseSensorPrefType">
  <complexContent>
    <extension base="scdv:UserSensorPreferenceBaseType"/>
  </complexContent>
</complexType>
```

[0420] An ambient noise sensor type is a tool for describing the sensor adaptation preference related to the ambient noise sensor.

[0421] An ambient noise sensor capability type may include sensor adaptation preference base attributes related to the ambient noise sensor.

[0422] The sensor adaptation preference base attributes related to the ambient noise sensor may include a maximum value, a minimum value, and a number of levels.

[0423] The maximum value denotes a maximum value of a user preference with respect to ambient noise information measured by the ambient noise sensor.

[0424] The minimum value denotes a minimum value of the user preference with respect to the ambient noise information measured by the ambient noise sensor.

[0425] The number of levels denotes a number of levels of the user preference with respect to the ambient noise information measured by the ambient noise sensor.

[0426] Table 34 denotes a sensor adaptation preference related to an atmospheric pressure sensor using the XML. However, a program source shown in Table 34 is not limiting but only an example embodiment.

[Table 34]

```

<!-- ##### -->
<!-- Atmospheric Pressure Sensor Preference type
-->
<!-- ##### -->
<complexType name="AtmosphericPressureSensorPrefType">
  <complexContent>
    <extension base="scdv:UserSensorPreferenceBaseType"/>
  </complexContent>
</complexType>

```

[0427] An atmospheric pressure sensor type is a tool for describing the sensor adaptation preference related to the atmospheric pressure sensor.

[0428] An atmospheric pressure sensor capability type may include sensor adaptation preference base attributes related to the atmospheric pressure sensor.

[0429] The sensor adaptation preference base attributes related to the atmospheric pressure sensor may include a maximum value, a minimum value, and a number of levels.

[0430] The maximum value denotes a maximum value of a user preference with respect to atmospheric pressure information measured by the atmospheric pressure sensor.

[0431] The minimum value denotes a minimum value of the user preference with respect to the atmospheric pressure information measured by the atmospheric pressure sensor.

[0432] The number of levels denotes a number of levels of the user preference with respect to the atmospheric pressure information measured by the atmospheric pressure sensor.

[0433] Table 35 denotes a sensor adaptation preference related to a velocity sensor using the XML. However, a program source shown in Table 35 is not limiting but only an example embodiment.

[Table 35]

```

<!-- ##### -->
<!-- Velocity Sensor Preference type -->
<!-- ##### -->
<complexType name="VelocitySensorPrefType">
  <complexContent>
    <extension base="cid:SensorCapabilityBaseType"/>
  </complexContent>
</complexType>

```

[0434] A velocity sensor type is a tool for describing the sensor adaptation preference related to the velocity sensor.

[0435] A velocity sensor capability type may include sensor adaptation preference base attributes related to the velocity sensor.

[0436] The sensor adaptation preference base attributes related to the velocity sensor may include a maximum value, a minimum value, and a number of levels.

[0437] The maximum value denotes a maximum value of a user preference with respect to velocity information measured by the velocity sensor.

[0438] The minimum value denotes a minimum value of the user preference with respect to the velocity information measured by the velocity sensor.

[0439] The number of levels denotes a number of levels of the user preference with respect to the velocity information measured by the velocity sensor.

[0440] Table 36 denotes a sensor adaptation preference related to an angular velocity sensor using the XML. However, a program source shown in Table 36 is not limiting but only an example embodiment.

[Table 36]

```

<!-- ##### -->
<!-- Angular Velocity Sensor Preference type --
>
5 <!-- #####-->
  <complexType name="AngularVelocitySensorPrefType">
    <complexContent>
      <extension base=cid: SensorCapabilityBaseType/>
    </complexContent>
10 </complexType>

```

[0441] An angular velocity sensor type is a tool for describing the sensor adaptation preference related to the angular velocity sensor.

[0442] An angular velocity sensor capability type may include sensor adaptation preference base attributes related to the angular velocity sensor.

[0443] The sensor adaptation preference base attributes related to the angular velocity sensor may include a maximum value, a minimum value, and a number of levels.

[0444] The maximum value denotes a maximum value of a user preference with respect to angular velocity information measured by the angular velocity sensor.

[0445] The minimum value denotes a minimum value of the user preference with respect to the angular velocity information measured by the angular velocity sensor.

[0446] The number of levels denotes a number of levels of the user preference with respect to the angular velocity information measured by the angular velocity sensor.

[0447] Table 37 denotes a sensor adaptation preference related to an angular acceleration sensor using the XML. However, a program source shown in Table 37 is not limiting but only an example embodiment.

[Table 37]

```

<!-- ##### -->
<!-- Angular Acceleration Sensor Preference type -->
30 <!-- ##### -->
  <complexType name="AngularAccelerationSensorPrefType">
    <complexContent>
      <extension base=cid: SensorCapabilityBaseType/>
    </complexContent>
35 </complexType>

```

[0448] An angular acceleration sensor type is a tool for describing the sensor adaptation preference related to the angular acceleration sensor.

[0449] An angular acceleration sensor capability type may include sensor adaptation preference base attributes related to the angular acceleration sensor.

[0450] The sensor adaptation preference base attributes related to the angular acceleration sensor may include a maximum value, a minimum value, and a number of levels.

[0451] The maximum value denotes a maximum value of a user preference with respect to angular acceleration information measured by the angular acceleration sensor.

[0452] The minimum value denotes a minimum value of the user preference with respect to the angular acceleration information measured by the angular acceleration sensor.

[0453] The number of levels denotes a number of levels of the user preference with respect to the angular acceleration information measured by the angular acceleration sensor.

[0454] Table 38 denotes a sensor adaptation preference related to a force sensor using the XML. However, a program source shown in Table 38 is not limiting but only an example embodiment.

[Table 38]

```

<!-- ##### -->
<!-- Force Sensor Preference type Preference type -->
55 <!-- ##### -->
  <complexType name="ForceSensorPrefType">
    <complexContent>
      <extension base="scdv:SensorCapabilityBaseType">

```

(continued)

```

        </extension>
    </ complexContent>
</complexType>

```

[0455] A force sensor type is a tool for describing the sensor adaptation preference related to the force sensor.

[0456] A force sensor capability type may include sensor adaptation preference base attributes related to the force sensor.

[0457] The sensor adaptation preference base attributes related to the force sensor may include a maximum value and, a minimum value, and a number of levels.

[0458] The maximum value denotes a maximum value of a user preference with respect to force information measured by the force sensor.

[0459] The minimum value denotes a minimum value of the user preference with respect to the force information measured by the force sensor.

[0460] The number of levels denotes a number of levels of the user preference with respect to the force information measured by the force sensor.

[0461] Table 39 denotes a sensor adaptation preference related to a torque sensor using the XML. However, a program source shown in Table 39 is not limiting but only an example embodiment.

[Table 39]

```

<!-- ##### -->
<!-- Torque Sensor Preference type Preference type -->
<!-- ##### -->
<complexType name="ForceSensorPrefType">
    <complexContent>
        <extension base="scdv:SensorCapabilityBaseType">
            </extension>
        </complexContent>
    </complexType>

```

[0462] A torque sensor type is a tool for describing the sensor adaptation preference related to the torque sensor.

[0463] A torque sensor capability type may include sensor adaptation preference base attributes related to the torque sensor.

[0464] The sensor adaptation preference base attributes related to the torque sensor may include a maximum value and, a minimum value, and a number of levels.

[0465] The maximum value denotes a maximum value of a user preference with respect to torque information measured by the torque sensor.

[0466] The minimum value denotes a minimum value of the user preference with respect to the torque information measured by the torque sensor.

[0467] The number of levels denotes a number of levels of the user preference with respect to the torque information measured by the torque sensor.

[0468] Table 40 denotes a sensor adaptation preference related to a pressure sensor using the XML. However, a program source shown in Table 40 is not limiting but only an example embodiment.

[Table 40]

```

<!-- ##### -->
<!-- Pressure Sensor Preference type -->
<!--#####-->
<complexType name="PressureSensorPrefType">
    <complexContent>
        <extension base="scdv:SensorCapabilityBaseType">
            </extension>
        </complexContent>
    </complexType>

```

[0469] A pressure sensor type is a tool for describing the sensor adaptation preference related to the pressure sensor.

[0470] A pressure sensor capability type may include sensor adaptation preference base attributes related to the

pressure sensor.

[0471] The sensor adaptation preference base attributes related to the pressure sensor may include a maximum value and, a minimum value, and a number of levels.

[0472] The maximum value denotes a maximum value of a user preference with respect to pressure information measured by the pressure sensor.

[0473] The minimum value denotes a minimum value of the user preference with respect to the pressure information measured by the pressure sensor.

[0474] The number of levels denotes a number of levels of the user preference with respect to the pressure information measured by the pressure sensor.

[0475] The virtual world processing apparatus according to the example embodiments may include sensed information.

[0476] The sensed information denotes a command for controlling the sensor. Depending on embodiments, the sensed information may be a command for controlling the sensor so as to reflect the information on the motion, state, intention, shape, and the like of the user of the real world, measured through the sensor, to the virtual world.

[0477] Depending on embodiments, the sensed information may serve as a root element for sensed information metadata.

[0478] Hereinafter, the sensed information will be described in detail with reference to FIG. 18.

[0479] FIG 18 illustrates a sensed information base type 1000 according to example embodiments.

[0480] Referring to FIG. 18, the sensed information base type 1000 may include sensed information base attributes 1010 and any attributes 1020.

[0481] The sensed information base type 1000 may be a topmost type of a base type that may inherit an individual piece of the sensed information.

[0482] The sensed information base attributes 1010 denote a group of attributes for the commands.

[0483] The any attributes 1020 denote a group of additional sensed information. The any attributes 1020 may be unique additional sensed information applicable to an arbitrary sensor. The any attributes 1020 may allow for the inclusion of any attributes defined within a namespace other than the target namespace.

[0484] Table 41 may be a program denoting a sensed information base type using the XML. However, Tabel 41 is not limiting but only an example embodiment.

[Table 41]

```
<!-- ##### -->
<!-- Sensed information base type -->
<!-- ##### -->
<complexType name="SensedInfoBaseType" abstract="true">
  <sequence>
    <element name="TimeStamp" type="mpegvct:TimeStampType"
35      use="optional" />
  </sequence>
  <attributeGroup ref="iidl:SensedInfoBaseAttributes"/>
</complexType>
```

[0485] Table 41-2 shows binary encoding syntax related to a sensed information base type according to example embodiments.

[Table 41-2]

SensedInfoBaseTypeType{	(Number of bits)	Mnemonic
TimeStampFlag	1	bslbf
SensedInfoBaseAttributes		SensedInfoBaseAttributesType
If(TimeStampFlag){		
TimeStamp		TimeStampType
}		
}		

[0486] Table 41-3 shows descriptor components semantics of the sensed information base type according to the example embodiments.

[Table 41-3]

Names	Description
SensedInfoBaseTypeType	Tool for describing sensed information base type.
TimeStampFlag	This field, which is only present in the binary representation, signals the presence of the timestamp element. A value of "1" means the timestamp shall be used and "0" means the timestamp shall not be used.
SensedInfoBaseAttributes	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
TimeStamp	Provides the timing information for the sensed information to be executed. As defined in Part 6 of ISO/IEC 23005, there is a choice of selection among three timing schemes, which are absolute time, clock tick time, and delta of clock tick time

[0487] The sensed information base attributes 1010 may include an ID 1011, a sensor reference ID 1012, a group ID 1013, a priority 1014, an activation state, and a linked list 1016.

[0488] The ID 1011 denotes ID information for recognizing individual identity of the sensor.

[0489] The sensor reference ID 1012 may be information referencing an ID of the sensor that generates information included in particular sensed information.

[0490] The group ID 1013 denotes ID information for recognizing individual identity of a multi-sensor structure to which a particular sensor belongs.

[0491] The priority 1014 denotes information on a priority related to sensed information of sensors in the same group, the sensors sharing the same point at time when the sensed information is applied. Depending on embodiments, a value 1 may represent a highest priority and larger values may indicate lower priorities.

[0492] The activation state 1015 denotes information for determining whether the sensor is in operation.

[0493] The linked list 1016 denotes information on link data for grouping a plurality of sensors. Depending on embodiments, the linked list 1016 may be information on a multi-sensor structure for grouping the sensors by a method including reference information on IDs of neighboring sensors.

[0494] Depending on embodiments, the sensed information base attributes 1010 may further include a value, a timestamp, and a life span.

[0495] The value denotes a measured value of the sensor. The value may be received from the sensor.

[0496] The timestamp denotes information on a sensing time of the sensor.

[0497] The life span denotes information on a valid period of a sensor command. Depending on embodiments, the life span may be a second unit.

[0498] The sensed information base attributes including the ID 1101, the sensor ID reference 1012, the group ID 1013, the priority 1014, the activation state 1015, the linked list 1016, the value, the timestamp, and the lifespan may be rearranged as shown in Table 42.

[Table 42]

Name	Definition
id 1011	Individual identity of sensor
sensorIdRef 1012	References a sensor that has generated the information included in this specific sensed information.
groupId 1013	Identifier for a group multi-sensor structure to which this specific sensor belongs.
Priority 1014	Describes the priority for sensed information with respect to other sensed information in the same group of sensors sharing the same point in time when the sensed information become adapted. A value of one indicates the highest priority and larger values indicate lower priorities.
Activate 1015	whether the effect shall be activated. a value of true means the effect shall be activated and false means the effect shall be deactivated.
Linked list 1016	grouping sensor structure that consists of a group of sensors such that in each record there is a field that contains a reference (id) to the next sensor.

(continued)

Name	Definition
Value	the value of the effect in percentage according to the max scale defined within the semantics definition of the individual effects.
Time stamp	information on a sensing time of the sensor
Life span	information on a valid period of a sensor command (expressed with reference to the timestamp in units of second)

[0499] Table 43 may be a program representing the sensed information base attributes using the XML.

[Table 43]

```

<!-- ##### -->
<!-- Definition of Sensed information Base Attributes -->
<!-- ##### -->
<attributeGroup name="SensedInfoBaseAttributes">
  <attribute name="id" type="ID" use="optional"/>
  <attribute name="sensorIdRef" type="anyURI"
  use="optional"/>
  <attribute name="linkedlist" type="anyURI" use="optional"/>
  <attribute name="groupId" type="anyURI" use="optional"/>
  <attribute name="priority" type="PositiveInteger"
  use="optional"/>
  <attribute name="activate" type="boolean" use="optional"/>
</attributeGroup>

```

[0500] Table 43-2 shows binary encoding syntax related to the sensed information base attributes according to example embodiments.

[Table 43-2]

Sensed InfoBaseAttributesType{	(Number of bits)	Mnemonic
IDFlag	1	bslbf
sensorIdRefFlag	1	bslbf
linkedlistFlag	1	bslbf
groupIdFlag	1	bslbf
priorityFlag	1	bslbf
activate Flag	1	bslbf
If(IDFlag) {		
ID	See ISO 10646	UTF-8
}		
if(sensorIdRefFlag) {		
sensorIdRefLength		vluimsbf5
sensorIdRe	8* sensorIdRefLength	bslbf
}		
if(linkedlistFlag) {		
linkedlistLength		vluimsbf5
linkedlist	8* linkedlistLength	bslbf
}		

(continued)

Sensed InfoBaseAttributesType{	(Number of bits)	Mnemonic
if(groupIDFlag) {		
groupIDLength		vluimsbf5
groupID	8* groupIDLength	bslbf
}		
if(priorityFlag) {		
priority	8	uimsbf
}		
if(activateFlag) {		
activate	1	bslbf
}		
}		

[0501] Table 43-3 shows descriptor components semantics of the sensed information base attributes according to the example embodiments.

[Table 43-3]

bslbf	Bit string, left bit first, where "left" is the order in which bits are written in ISO/IEC 15938-3. Bit strings are generally written as a string of 1s and 0s within single quote marks, e.g. '1000 0001'. Blanks within a bit string are for ease of reading and have no significance. For convenience, large strings are occasionally written in hexadecimal, in which case conversion to a binary in the conventional manner will yield the value of the bit string. Thus, the left-most hexadecimal digit is first and in each hexadecimal digit the most significant of the four digits is first.
UTF-8	Binary string encoding defined in ISO 10646/IETF RFC 2279.
vluimsbf5	Variable length unsigned integer most significant bit first representation consisting of two parts. The first part defines the number n of 4-bit bit fields used for the value representation, encoded by a sequence of n-1 "1" bits, followed by a "0" bit signaling its end. The second part contains the value of the integer encoded using the number of bit fields specified in the first part.
uimsbf	Unsigned integer, most significant bit first.
fsbf	Float (32 bit), sign bit first. The semantics of the bits within a float are specified in the IEEE Standard for Binary Floating Point Arithmetic (ANSI/IEEE Std 754-1985).

[0502] Hereinafter, the sensed information of the sensor will be described in relation to specific embodiments.

[0503] Table 44 shows sensed information related to a position sensor using the XML. However, a program source shown in Table 44 is not limiting but only an example embodiment.

[Table 44]

```

<!--##### -->
<!--Definition of Position Sensor type -->
<!--##### -->
<complexType name="PositionSensorType">
  <complexContent>
    <extension base="iidl:SensedInfoBaseType">
      <sequence>
        <element name="position"

```

(continued)

```

        type="mpegvct:Float3DVectorType" minOccurs="0"/>
      </sequence>
      <attribute name="timestamp" type="float" use="optional"/>
      <attribute name="unit" type="mpegvct:unitType"
        use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0504] A position sensor type is a tool for describing sensed information related to the position sensor.

[0505] The position sensor type may include attributes such as a timestamp, a life span, a position, a position value type, Px, Py, and Pz.

[0506] The timestamp denotes information on a sensing time of the position sensor.

[0507] The life span denotes information on a valid period of a command of the position sensor. For example, the life span may be a second unit.

[0508] The position denotes information on a 3-dimensional (3D) value of the position sensor, expressed by a unit of distance, for example, meter.

[0509] The position value type denotes a tool for indicating a 3D position vector.

[0510] The Px denotes information on an x-axis value of the position sensor.

[0511] The Py denotes information on a y-axis value of the position sensor.

[0512] The Pz denotes information on a z-axis value of the position sensor.

[0513] Table 45 and Table 46 denote binary representation syntax corresponding to the sensed information related to the position sensor according to the example embodiments.

[Table 45]

PositionSensorType {	Number of bits	Mnemonic
positionFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(positionFlag) {		
position		Float3DVectorType
}		
if(unitFlag) {		
Unit		unitType
}		
}		

[Table 46]

Float3DVectorType {	Number of bits	Mnemonic
X	32	fsbf
Y	32	fsbf
Z	32	fsbf
}		

[0514] Table 45 and Table 46 may include binary encoding syntax of the sensed information related to the position sensor, the number of bits occupied by attributes of the binary encoding syntax, and a mnemonic of the attributes.

[0515] For example, the binary encoding syntax corresponding to the sensed information of the position sensor may

include a priority denoting a priority of the position sensor. Here, the number of bits occupied by the priority may be 8 bits. A priority mnemonic may be uimbsf which stands for 'unsigned integer most significant bit first.'

[0516] Depending on embodiments, the mnemonic may further include bsibf which stands for 'bit string left bit first' and Unicode transformation format-8 (UTF-8) which stands for a variable length letter encoding method for Unicode. UTF-8 may use 1 to 4 bytes to express one Unicode letter.

[0517] Table 47 shows a mnemonic of data.

[Table 47]

bsibf	Bit string, left bit first, where "left" is the order in which bits are written in ISO/IEC 15938-3. Bit strings are generally written as a string of 1s and 0s within single quote marks, e.g. '1000 0001'. Blanks within a bit string are for ease of reading and have no significance. For convenience, large strings are occasionally written in hexadecimal, in which case conversion to a binary in the conventional manner will yield the value of the bit string. Thus, the left-most hexadecimal digit is first and in each hexadecimal digit the most significant of the four digits is first.
UTF-8	Binary string encoding defined in ISO 10646/IETF RFC 2279.
vluimbsf5	Variable length unsigned integer most significant bit first representation consisting of two parts. The first part defines the number n of 4-bit bit fields used for the value representation, encoded by a sequence of n-1 "1" bits, followed by a "0" bit signaling its end. The second part contains the value of the integer encoded using the number of bit fields specified in the first part.
uimbsf	Unsigned integer, most significant bit first.
fsbf	Float (32 bit), sign bit first. The semantics of the bits within a float are specified in the IEEE Standard for Binary Floating Point Arithmetic (ANSI/IEEE Std 754-1985).

[0518] Table 48 shows descriptor components semantics of the position sensor according to example embodiments.

[Table 48]

Names	Description
PositionSensorType	Tool for describing sensed information with respect to a position sensor.
positionFlag	This field, which is only present in the binary \ representation, signals the presence of senso value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
position	Describes the sensed value of the position sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.
Float3DVectorType	Tool for describing a 3D position vector
X	Describes the sensed position in x-axis in the unit of meter.
Y	Describes the sensed position in y-axis in the unit of meter.
Z	Describes the sensed position in z-axis in the unit of meter.

[0519] Table 49 shows sensed information related to an orientation sensor using the XML. However, a program source shown in Table 49 is not limiting but only an example embodiment.

[Table 49]

```

5      <!--##### -->

      <!--Definition of Orientation Sensor type -->

10     <!--##### -->

      <complexType name="OrientationSensorType">

          <complexContent>

15              <extension base="iidl:SensedInfoBaseType">

                  <sequence>

20                      <element          name="orientation"

type="mpegvct:Float3DVectorType" minOccurs="0"/>

25

                      </sequence>

                      <attribute    name="timestamp"    type="float"

30      use="optional"/>

                      <attribute          name="unit"

35      type="mpegvct:unitType" use="optional"/>

                      </extension>

40              </complexContent>

          </complexType>

```

[0520] An orientation sensor type is a tool for describing sensed information related to the orientation sensor.

[0521] The orientation sensor type may include attributes such as a timestamp, a life span, an orientation, an orientation value type, Ox, Oy, and Oz.

[0522] The timestamp denotes information on a sensing time of the orientation sensor.

[0523] The life span denotes information on a valid period of a command of the orientation sensor. For example, the life span may be a second unit.

[0524] The orientation denotes information on a 3D value of the orientation sensor, expressed by a unit of orientation, for example, radian.

[0525] The orientation value type denotes a tool for indicating a 3D orientation vector.

[0526] The Ox denotes information on a value of an x-axis rotation angle of the orientation sensor.

[0527] The Oy denotes information on a value of a y-axis rotation angle of the orientation sensor.

[0528] The Oz denotes information on a value of a z-axis rotation angle of the orientation sensor.

[0529] Table 50 shows binary representation syntax corresponding to the sensed information related to the orientation

sensor according to the example embodiments.

[Table 50]

OrientationSensorType{	Number of bits	Mnemonic
orientationFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(orientationFlag) {		
Orientation		Float3DVectorType
}		
if(unitFlag) {		
Unit		unitType
}		
}		

[0530] Table 51 shows descriptor components semantics of the orientation sensor according to the example embodiments.

[Table 51]

Names	Description
OrientationSensorType	Tool for describing sensed information with respect to an orientation sensor.
orientationFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
orientation	Describes the sensed value of the orientation sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.
Names	Description
OrientationSensorType	Tool for describing sensed information with respect to an orientation sensor.
orientationFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
orientation	Describes the sensed value of the orientation sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

(continued)

Names	Description
OrientationSensorType	Tool for describing sensed information with respect to an orientation sensor.
orientationFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
orientation	Describes the sensed value of the orientation sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.
Names	Description
OrientationSensorType	Tool for describing sensed information with respect to an orientation sensor.
orientationFlag	This field, which is only present in the binary \ representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
orientation	Describes the sensed value of the orientation sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.
OrientationSensorType	Tool for describing sensed information with respect to an orientation sensor.

[0531] Table 52 shows sensed information related to an acceleration sensor using the XML. However, a program source shown in Table 52 is not limiting but only an example embodiment.

[Table 52]

```

<!--##### -->
  <!--Definition of Acceleration Sensor type -->
  <!--##### -->
  <complexType name="AccelerationSensorType">
    <complexContent>
      <extension base="idl:SensedInfoBaseType">
        <sequence>
          <element name="acceleration"
            type="mpegvct:Float3DVectorType" minOccurs="0"/>
        </sequence>
        <attribute name="timestamp" type="float"
          use="optional"/>
        <attribute name="unit"
          type="mpegvct:unitType" use="optional"/>
      </extension>
    </complexContent>
  </complexType>

```

[0532] An acceleration sensor type is a tool for describing sensed information related to the acceleration sensor.

[0533] The acceleration sensor type may include attributes such as a timestamp, a life span, an acceleration, an acceleration value type, Ax, Ay, and Az.

[0534] The timestamp denotes information on a sensing time of the acceleration sensor.

[0535] The life span denotes information on a valid period of a command of the acceleration sensor. For example, the life span may be a second unit.

[0536] The acceleration denotes information on a value of the acceleration sensor, expressed by a unit of acceleration, for example, m/s².

[0537] The acceleration value type denotes a tool for indicating a 3D acceleration vector.

[0538] The Ax denotes information on an x-axis value of the acceleration sensor.

[0539] The Ay denotes information on a y-axis value of the acceleration sensor.

[0540] The Az denotes information on a z-axis value of the acceleration sensor.

[0541] Table 53 shows binary representation syntax corresponding to the sensed information related to the acceleration sensor according to the example embodiments.

[Table 53]

AccelerationSensorType {	Number of bits	Mnemonic
accelerationFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(accelerationFlag) {		
acceleration		Float3DVectorType
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0542] Table 54 shows descriptor components semantics of the acceleration sensor according to the example embodiments.

[Table 54]

Names	Description
AccelerationSensorType	Tool for describing sensed information with respect to an acceleration sensor.
accelerationFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
acceleration	Describes the sensed value of the acceleration sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0543] Table 55 denotes sensed information related to a light sensor using the XML. However, a program source shown in Table 55 is not limiting but only an example embodiment.

[Table 55]

```

<!--##### -->
<!--Definition of Light Sensor type -->
<!--##### -->
5  <complexType name="LightSensorType">
    <complexContent>
        <extension base="iidl:SensedInfoBaseType">
            <attribute name="value" type="float"
            use="optional"/>
10        <attribute name="unit" type="iidl:unitType"
            use="optional"/>
            <attribute name="color" type="iidl:colorType"
            use="optional"/>
        </extension>
    </complexContent>
15 </complexType>

```

[0544] A light sensor type is a tool for describing sensed information related to the light sensor.

[0545] The light sensor type may include attributes such as a timestamp, a life span, a value, and a color.

[0546] The timestamp denotes information on a sensing time of the light sensor.

[0547] The life span denotes information on a valid period of a command of the light sensor. For example, the life span may be a second unit.

[0548] The value denotes information on a light sensor value expressed by a unit of light intensity, for example, LUX.

[0549] The color denotes a color that may be provided by the light sensor. For example, the color may be RGB color value.

[0550] Table 56 shows binary representation syntax corresponding to the sensed information related to the light sensor according to the example embodiments.

[Table 56]

LightSensorType {	Number of bits	Mnemonic
valueFlag	1	bslbf
unitFlag	1	bslbf
colorFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(valueFlag) {		
value	32	fsbf
}		
if(unitFlag) {		
unit		unitType
}		
if(colorFlag) {		
color		colorType
}		
}		

[0551] Table 57 shows binary encoding of a unit CS corresponding to the light sensor according to the example embodiments. Table 57 may include a unit type and a term ID of unit.

EP 2 557 481 B1

[Table 57]

unitType	Term ID of unit
00000000	micrometer
00000001	mm
00000010	cm
00000011	meter
00000100	km
00000101	inch
00000110	yard
00000111	mile
00001000	mg
00001001	gram
00001010	kg
00001011	ton
00001100	micrometerpersec
00001101	mmpersec
00001110	cmpersec
00001111	meterpersec
00010000	Kmpersec
00010001	inchpersec
00010010	yardpersec
00010011	milepersec
00010100	micrometerpermin
00010101	mmpermin
00010110	cmpermin
00010111	meterpermin
00011000	kmpermin
00011001	inchpermin
00011010	yardpermin
00011011	milepermin
00011100	micrometerperhour
00011101	mmperhour
00011110	cmperhour
00011111	meterperhour
00100000	kmperhour
00100001	inchperhour
00100010	yardperhour
00100011	mileperhour
00100100	micrometerpersecsquare
00100101	mmpersecsquare

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

unitType	Term ID of unit
00100110	cmpersecsquare
00100111	meterpersecsquare
00101000	kmpersecsquare
00101001	inchpersecsquare
00101010	yardpersecsquare
00101011	milepersecsquare
00101100	micormeterperminsquare
00101101	mmperminsquare
00101110	cmrperminsquare
00101111	meterperminsquare
00110000	kmpersminsquare
00110001	inchperminsquare
00110010	yardperminsquare
00110011	mileperminsquare
00110100	micormeterperhoursquare
00110101	mmperhoursquare
00110110	cmperhoursquare
00110111	meterperhoursquare
00111000	kmperhoursquare
00111001	inchperhoursquare
00111010	yardperhoursquare
00111011	mileperhoursquare
00111100	Newton
00111101	Nmm
00111110	Npmm
00111111	Hz
01000000	KHz
01000001	MHz
01000010	GHz
01000011	volt
01000100	millivolt
01000101	ampere
01000110	milliampere
01000111	milliwatt
01001000	watt
01001001	kilowatt
01001010	lux
01001011	celsius

(continued)

unitType	Term ID of unit
01001100	fahrenheit
01001101	radian
01001110	degree
01001111	radpersec
01010000	degpersec
01010001	radpersecsquare
01010010	degpersecsquare
01010011	Npermmsquare
01011100 - 11111111	Reserved

[0552] Table 58 shows binary encoding of a unit CS corresponding to the light sensor according to the example embodiments. Table 58 may include a color type and a term ID of unit.

[Table 58]

colorType	Term ID of color
000000000	alice_blue
000000001	alizarin
000000010	amaranth
000000011	amaranth_pink
000000100	amber
000000101	amethyst
000000110	apricot
000000111	aqua
000001000	aquamarine
000001001	army_green
000001010	asparagus
000001011	atomic_tangerine
000001100	auburn
000001101	azure_color_wheel
000001110	azure_web
000001111	baby_blue
000010000	beige
000010001	bistre
000010010	black
000010011	blue
000010100	blue_pigment
000010101	blue_ryb
000010110	blue_green
000010111	blue-green

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
000011000	blue-violet
000011001	bondi_blue
000011010	brass
000011011	bright_green
000011100	bright_pink
000011101	bright_turquoise
000011110	brilliant_rose
000011111	brink_pink
000100000	bronze
000100001	brown
000100010	buff
000100011	burgundy
000100100	burnt_orange
000100101	burnt_sienna
000100110	burnt_umber
000100111	camouflage_green
000101000	caput_mortuum
000101001	cardinal
000101010	carmine
000101011	carmine_pink
000101100	carnation_pink
000101101	Carolina_blue
000101110	carrot_orange
000101111	celadon
000110000	cerise
000110001	cerise_pink
000110010	cerulean
000110011	cerulean_blue
000110100	champagne
000110101	charcoal
000110110	chartreuse_traditional
000110111	chartreuse_web
000111000	cherry_blossom_pink
000111001	chestnut
000111010	chocolate
000111011	cinnabar
000111100	cinnamon
000111101	cobalt

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
000111110	Columbia_blue
000111111	copper
001000000	copper_rose
001000001	coral
001000010	coral_pink
001000011	coral_red
001000100	corn
001000101	cornflower_blue
001000110	cosmic_latte
001000111	cream
001001000	crimson
001001001	cyan
001001010	cyan_process
001001011	dark_blue
001001100	dark_brown
001001101	dark_cerulean
001001110	dark_chestnut
001001111	dark_coral
001010000	dark_goldenrod
001010001	dark_green
001010010	dark_khaki
001010011	dark_magenta
001010100	dark_pastel_green
001010101	dark_pink
001010110	dark_scarlet
001010111	dark_salmon
001011000	dark_slate_gray
001011001	dark_spring_green
001011010	dark_tan
001011011	dark_turquoise
001011100	dark_violet
001011101	deep_carmine_pink
001011110	deep_cerise
001011111	deep_chestnut
001100000	deep_fuchsia
001100001	deep_lilac
001100010	deep_magenta
001100011	deep_magenta

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
001100100	deep_peach
001100101	deep_pink
001100110	denim
001100111	dodger_blue
001101000	ecru
001101001	egyptian_blue
001101010	electric_blue
001101011	electric_green
001101100	elctric_indigo
001101101	electric_lime
001101110	electric_purple
001101111	emerald
001110000	eggplant
001110001	fal_u_red
001110010	fern_green
001110011	firebrick
001110100	flax
001110101	forest_green
001110110	french_rose
001110111	fuchsia
001111000	fuchsia_pink
001111001	gamboge
001111010	gold_metallic
001111011	gold_web_golden
001111100	golden_brown
001111101	golden_yellow
001111110	goldenrod
001111111	grey-asparagus
010000000	green_color_wheel_x11_green
010000001	green_html/css_green
010000010	green_pigment
010000011	green_ryb
010000100	green_yellow
010000101	grey
010000110	han_purple
010000111	harlequin
010001000	heliotrope
010001001	Hollywood_cerise

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
010001010	hot_magenta
010001011	hot_pink
010001100	indigo_dye
010001101	international_klein_blue
010001110	international_orange
010001111	Islamic_green
010010000	ivory
010010001	jade
010010010	kelly_green
010010011	khaki
010010100	khaki_x11_light_khaki
010010101	lavender_floral
010010110	lavender_web
010010111	lavender_blue
010011000	lavender_blush
010011001	lavender_grey
010011010	lavender_magenta
010011011	lavender_pink
010011100	lavender_purple
010011101	lavender_rose
010011110	lawn_green
010011111	lemon
010100000	lemon_chiffon
010100001	light_blue
010100010	light_pink
010100011	lilac
010100100	lime_color_wheel
010100101	lime_web_x11_green
010100110	lime_green
010100111	linen
010101000	magenta
010101001	magenta_dye
010101010	magenta_process
010101011	magic_mint
010101100	magnolia
010101101	malachite
010101110	maroon_html/css
010101111	marron_x11

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
010110000	maya_blue
010110001	mauve
010110010	mauve_taupe
010110011	medium_blue
010110100	medium_carmine
010110101	medium_lavender_magenta
010110110	medum_purple
010110111	medium_spring_green
010111000	midnight_blue
010111001	midnight_green_eagle_green
010111010	mint_green
010111011	misty_rose
010111100	moss_green
010111101	mountbatten_pink
010111110	mustard
010111111	myrtle
011000000	navajo_white
011000001	navy_blue
011000010	ochre
011000011	office_green
011000100	old_gold
011000101	old_lace
011000110	old_lavender
011000111	old_rose
011001000	olive
011001001	olive_drab
011001010	olivine
011001011	orange_color_wheel
011001100	orange_ryb
011001101	orange_web
011001110	orange_peel
011001111	orange-red
011010000	orchid
011010001	pale_blue
011010010	pale_brown
011010011	pale_carmine
011010100	pale_chestnut
011010101	pale_cornflower_blue

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
011010110	pale_magenta
011010111	pale_pink
011011000	pale_red-violet
011011001	papaya_whip
011011010	pastel_green
011011011	pastel_pink
011011100	peach
011011101	peach-orange
011011110	peach-yellow
011011111	pear
011100000	periwinkle
011100001	persian_blue
011100010	persian_green
011100011	persian_indigo
011100100	persian_orange
011100101	persian_red
011100110	persian_pink
011100111	persian_rose
011101000	persimmon
011101001	pine_green
011101010	pink
011101011	pink-orange
011101100	platinum
011101101	plum_web
011101110	powder_blue_web
011101111	puce
011110000	prussian_blue
011110001	psychedelic_purple
011110010	pumpkin
011110011	purple_html/css
011110100	purple_x11
011110101	purple_taupe
011110110	raw_umber
011110111	razzmatazz
011111000	red
011111001	red_pigment
011111010	red_ryb
011111011	red-violet

EP 2 557 481 B1

(continued)

5

10

15

20

25

30

35

40

45

50

55

colorType	Term ID of color
011111100	rich_carmine
011111101	robin_egg_blue
011111110	rose
011111111	rose_madder
100000000	rose_taupe
100000001	royal_blue
100000010	royal_purple
100000011	ruby
100000100	russet
100000101	rust
100000110	safety_orange_blaze_orange
100000111	saffron
100001000	salmon
100001001	sandy_brown
100001010	sangria
100001011	sapphire
100001100	scarlet
100001101	school_bus_yellow
100001110	sea_green
100001111	seashell
100010000	selective_yellow
100010001	sepia
100010010	shamrock_green
100010011	shocking_pink
100010100	silver
100010101	sky_blue
100010110	slate_grey
100010111	smalt_dark_powder_blue
100011000	spring_bud
100011001	spring_green
100011010	steel_blue
100011011	tan
100011100	tangerine
100011101	tangerine_yellow
100011110	taupe
100011111	tea_green
100100000	tea_rose_orange
100100001	tea_rose_rose

(continued)

colorType	Term ID of color
100100010	teal
100100011	tenne tawny
100100100	terra_cotta
100100101	thistle
100100110	tomato
100100111	turquoise
100101000	tyrian_purple
100101001	ultramarine
100101010	ultra_pink
100101011	united_nation_blue
100101100	vegas_gold
100101101	vermilion
100101110	violet
100101111	violet_web
100110000	violet_ryb
100110001	viridian
100110010	wheat
100110011	white
100110100	wisteria
100110101	yellow
100110110	yellow_process
100110111	yellow_ryb
100111000	yellow_green
100111001 - 111111111	Reserved

[0553] Table 59 shows descriptor components semantics of the light sensor according to the example embodiments.

[Table 59]

Names	Description
LightSensorType	Tool for describing sensed information with respect to a light sensor.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
colorFlag	This field, which is only present in the binary representation, signals the presence of color attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
SensedInfoBaseType	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.

(continued)

Names	Description
value	Describes the sensed value of the light sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.
color	Describes the list of colors which the lighting device can sense as a reference to a classification scheme term or as RGB value. A CS that may be used for this purpose is the ColorCS defined in A.2.3 of ISO/IEC 23005-6 and use the binary representation defined above.

[0554] Table 60 denotes sensed information related to a sound sensor using the XML. However, a program source shown in Table 60 is not limiting but only an example embodiment.

[Table 60]

```

<!-- #####-->
<!-- SCmd Sound Sensor type -->
<!--#####-->
  <complexType name="SoundSensorType">
    <complexContent>
      <extension base="cid: SCmdBaseType"/>
    </complexContent>
  </complexType>

```

[0555] A sound sensor command type is a tool for describing sensed information related to the sound sensor.

[0556] Table 61 denotes sensed information related to a temperature sensor using the XML. However, a program source shown in Table 61 is not limiting but only an example embodiment.

[Table 61]

```

<!--##### -->
  <!--Definition of Temperature Sensor type -->
  <!--##### -->
    <complexType name="TemperatureSensorType">
      <complexContent>
        <extension base="iidl: SensedInfoBaseType">
          <attribute name="value" type="float"
            use="optional"/>
          <attribute name="unit" type="iidl:unitType"
            use="optional"/>
        </extension>
      </complexContent>
    </complexType>

```

A temperature sensor type is a tool for describing sensed information related to the temperature sensor.

[0557] The temperature sensor type may include attributes such as a timestamp, a life span, and a value.

[0558] The timestamp denotes information on a sensing time of the temperature sensor.

[0559] The life span denotes information on a valid period of a command of the temperature sensor. For example, the life span may be a second unit.

[0560] The value denotes information on a temperature sensor value expressed by a unit of temperature, for example, °C and °F.

[0561] Table 62 shows binary representation syntax corresponding to the sensed information related to the temperature sensor according to the example embodiments.

[Table 62]

TemperatureSensorType{	Number of bits	Mnemonic
valueFlag	1	bslbf
unitFlag	1	bslbf
if(valueFlag) {		
value	32	fsbf
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0562] Table 63 shows descriptor components semantics of the temperature sensor according to the example embodiments.

[Table 63]

Names	Description
TemperatureSensorType	Tool for describing sensed information with respect to a temperature sensor.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
value	Describes the sensed value of the temperature sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0563] Table 64 denotes sensed information related to a humidity sensor using the XML. However, a program source shown in Table 64 is not limiting but only an example embodiment.

[Table 64]

```

<!--##### -->
  <!--Definition of Humidity Sensor type -->
<!--##### -->
  <complexType name="HumiditySensorType">
    <complexContent>
      <extension base="idl:SensedInfoBaseType">
        <attribute name="value" type="float"
          use="optional"/>
        <attribute name="unit" type="idl:unitType"
          use="optional"/>
      </extension>
    </complexContent>
  </complexType>

```

[0564] A humidity sensor type is a tool for describing sensed information related to the humidity sensor.

[0565] The humidity sensor type may include attributes such as a timestamp, a life span, and a value.

[0566] The timestamp denotes information on a sensing time of the humidity sensor.

[0567] The life span denotes information on a valid period of a command of the humidit sensor For example, the life span may be a second unit.

[0568] The value denotes information on a humidity sensor value expressed by a unit of humidity, for example, %.

[0569] Table 65 shows binary representation syntax corresponding to the sensed information related to the humidity sensor according to the example embodiments.

[Table 65]

HumiditySensorType{	Number of bits	Mnemonic
valueFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(valueFlag) {		
value	32	fsbf
}		
if(unitFlag) {		
Unit		unitType
}		
}		

[0570] Table 66 shows descriptor components semantics of the humidity sensor according to the example embodiments.

[Table 66]

Names	Description
HumiditySensorType	Tool for describing sensed information with respect to a humidity sensor.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
value	Describes the sensed value of the humidity sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0571] Table 67 denotes sensed information related to a distance sensor using the XML. However, a program source shown in Table 67 is not limiting but only an example embodiment.

[Table 67]

```

<!--##### -->
<!--Definition of Distance Sensor type -->
<!--##### -->
<complexType name= DistanceSensorType">
  <complexContent>
    <extension base="iidl:SensedInfoBaseType">
      <attribute name="value" type="float"
        use="optional"/>
      <attribute name="unit" type="iidl:unitType"
        use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0572] A distance sensor type is a tool for describing sensed information related to the distance sensor.

[0573] The distance sensor type may include attributes such as a timestamp, a life span, and a value.

[0574] The timestamp denotes information on a sensing time of the distance sensor.

[0575] The life span denotes information on a valid period of a command of the distance sensor. For example, the life span may be a second unit.

[0576] The value denotes information on a distance sensor value expressed by a unit of distance, for example, meter.

[0577] Table 68 shows binary representation syntax corresponding to the sensed information related to the distance sensor according to the example embodiments.

[Table 68]

DistanceSensorType{	Number of bits	Mnemonic
valueFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(valueFlag) {		
value	32	fsbf
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0578] Table 69 shows descriptor components semantics of the distance sensor according to the example embodiments.

[Table 69]

Names	Description
DistanceSensorType	Tool for describing sensed information with respect to a distance sensor.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.

(continued)

Names	Description
value	Describes the sensed value of the humidity sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0579] Table 70 denotes sensed information related to a motion sensor using the XML. However, a program source shown in Table 70 is not limiting but only an example embodiment.

[Table 70]

```

5      <!-- ##### -->

      <!-- Definition of Motion Sensor Type -->

10     <!-- ##### -->

      <complexType name="MotionSensorType">

          <complexContent>

15              <extension base="iidl:SensedInfoBaseType">

                  <sequence>

20                      <element name="position"

type="siv:PositionSensorType" minOccurs="0"/>

25                      <element name="orientation"

type="siv:OrientationSensorType" minOccurs="0"/>

30                      <element name="velocity"

type="siv:VelocitySensorType" minOccurs="0"/>

35                      <element name="angularvelocity"

type="siv:AngularVelocitySensorType" minOccurs="0"/>

40                      <element name="acceleration"

type="siv:AccelerationSensorType" minOccurs="0"/>

45                      <element name="angularacceleration"

type="siv:AngularAccelerationSensorType" minOccurs="0"/>

                    </sequence>

50                </extension>

            </complexContent>

55        </complexType>

```

[0580] A motion sensor type is a tool for describing sensed information related to the length sensor.

[0581] The motion sensor type may include attributes such as an ID, an ID reference, a position, a velocity, an acceleration, an orientation, an angular velocity, and an angular acceleration.

[0582] The ID denotes ID information for recognizing individual identity of the motion sensor.

5 **[0583]** The ID reference denotes additional information related to the ID, the additional information for recognizing individual identity of the motion sensor.

[0584] The position denotes information on a position vector value of a unit of position, for example, meter.

[0585] The velocity denotes information on a velocity vector value of a unit of velocity, for example, m/s.

[0586] The acceleration denotes information on an acceleration vector value of a unit of velocity, for example, m/s².

10 **[0587]** The orientation denotes information on an orientation vector value of a unit of orientation, for example, radian.

[0588] The angular velocity denotes information on an angular velocity vector value of a unit of velocity, for example, radian/s.

[0589] The angular acceleration denotes information on a velocity vector value of a unit of velocity, for example, radian/s².

15 **[0590]** Table 71 shows binary representation syntax corresponding to the sensed information related to the motion sensor according to the example embodiments.

[Table 71]

20	MotionSensorType{	Number of bits	Mnemonic
	positionFlag	1	bslbf
	orientationFlag	1	bslbf
	velocityFlag	1	bslbf
25	angularvelocityFlag	1	bslbf
	accelerationFlag	1	bslbf
	angularaccelerationFlag	1	bslbf
30	SensedInfoBaseType		SensedInfoBaseTypeType
	if(positionFlag) {		
	position		PositionSensorType
	}		
35	if(orientationFlag) {		
	orientation		OrientationSensorType
	}		
40	if(velocityFlag) {		
	velocity		VelocitySensorType
	}		
45	if(angularvelocityFlag) {		
	angularvelocity		AngularVelocitySensorType
	}		
	if(accelerationFlag) {		
50	acceleration		AccelerationSensorType
	}		
	if(angularaccelerationFlag) {		
55	angularacceleration		AngularAccelerationSensorType
	}		

[0591] Table 72 shows descriptor components semantics of the motion sensor according to the example embodiments.

[Table 72]

Names	Description
MotionSensorType	Tool for describing sensed information with respect to a motion sensor.
positionFlag	This field, which is only present in the binary representation, signals the presence of position value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
orientationFlag	This field, which is only present in the binary representation, signals the presence of orientation value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
velocityFlag	This field, which is only present in the binary representation, signals the presence of velocity value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
angularvelocityFlag	This field, which is only present in the binary representation, signals the presence of angular velocity value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
accelerationFlag	This field, which is only present in the binary representation, signals the presence of acceleration value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
angularaccelerationFlag	This field, which is only present in the binary representation, signals the presence of angular acceleration value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
position	Describes the sensed position value of the motion sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
orientation	Describes the sensed orientation value of the motion sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
velocity	Describes the sensed velocity value of the motion sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
angularvelocity	Describes the sensed angular velocity value of the motion sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
acceleration	Describes the sensed acceleration value of the motion sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
angularacceleration	Describes the sensed angular acceleration value of the motion sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.

[0592] Table 73 denotes sensed information related to an intelligent camera sensor using the XML. However, a program source shown in Table 73 is not limiting but only an example embodiment.

[Table 73]

```

5      <!-- ##### -->

      <!-- Definition of Intelligent Camera Type -->

10     <!-- ##### -->

      <complexType name="IntelligentCameraType">

          <complexContent>

15              <extension base="iidl:SensedInfoBaseType">

                  <sequence>

20                      <element name="FacialAnimationID"

type="anyURI" minOccurs="0"/>

25                      <element name="BodyAnimationID"

type="anyURI" minOccurs="0"/>

30                      <element name="FaceFeature"

type="mpegvct:Float3DVectorType" minOccurs="0" maxOccurs="255"/>

35                      <element name="BodyFeature"

type="mpegvct:Float3DVectorType" minOccurs="0" maxOccurs="255"/>

40                  </sequence>

                  <attribute name="timestamp" type="float"

45                      use="optional"/>

                  </extension>

          </complexContent>

50     </complexType>

```

[0593] An intelligent camera sensor type is a tool for describing sensed information related to the intelligent camera sensor.

[0594] The intelligent camera sensor type may include a facial animation ID, a body animation ID, a face feature, and a body feature.

[0595] The facial animation ID denotes an ID referencing an animation clip with respect to a facial expression.

[0596] The body animation ID denotes an ID referencing an animation clip with respect to a body.

[0597] The face feature denotes information on a 3D position of each face feature sensed by the intelligent camera sensor.

[0598] The body feature denotes information on a 3D position of each body feature sensed by the intelligent camera sensor.

[0599] Table 74 shows binary representation syntax corresponding to the sensed information related to the intelligent camera sensor according to the example embodiments.

[Table 74]

IntelligentCameraType{	Number of bits	Mnemonic
FacialIDFlag	1	bslbf
BodyIDFlag	1	bslbf
FaceFeatureFlag	1	bslbf
BodyFeatureFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(FacialIDFlag) {		
FacialAnimationIDLength		vluimsbf5
FacialAnimationID	8* FacialAnimationIDLength	bslbf
}		
if(BodyIDFlag) {		
BodyAnimationIDLength		vluimsbf5
BodyAnimationID	8* BodyAnimationIDLength	bslbf
}		
if(FaceFeatureFlag) {		
NumOfFaceFeature	8	uimsbf
for(k=0; k<NumOfFaceFeature; k++) {		
FaceFeature[k]		Float3DVectorType
}		
}		
if(BodyFeatureFlag) {		
NumOfBodyFeature	8	uimsbf
for(k=0; k<NumOfBodyFeature; k++) {		
BodyFeature[k]		Float3DVectorType
}		
}		
}		

[0600] Table 75 shows descriptor components semantics of the intelligent camera sensor according to the example embodiments.

[Table 75]

Names	Description
IntelligentCameraType	Tool for describing sensed information with respect to an intelligent camera sensor.

(continued)

Names	Description
FacialIDFlag	This field, which is only present in the binary representation, signals the presence of the facial animation ID. A value of "1" means the facial animation ID mode shall be used and "0" means the facial animation ID mode shall not be used.
BodyIDFlag	This field, which is only present in the binary representation, signals the presence of the body animation ID. A value of "1" means the body animation ID mode shall be used and "0" means the body animation ID mode shall not be used.
FaceFeatureFlag	This field, which is only present in the binary representation, signals the presence of the face features. A value of "1" means the face feature tracking mode shall be used and "0" means the face feature tracking mode shall not be used.
BodyFeatureFlag	This field, which is only present in the binary representation, signals the presence of the body features. A value of "1" means the body feature tracking mode shall be used and "0" means the body feature tracking mode shall not be used.
FacialAnimationID Length	This field, which is only present in the binary representation, specifies the length of the following FacialAnimationID attribute.
FacialAnimationID	Describes the ID referencing the facial expression animation clip.
BodyAnimationIDLength	This field, which is only present in the binary representation, specifies the length of the following BodyAnimationID attribute.
BodyAnimationID	Describes the ID referencing the body animation clip.
NumOfFaceFeature	This field, which is only present in the binary representation, specifies the number of face feature points.
FaceFeature	Describes the 3D position of each of the face feature points detected by the camera.
	Note: The order of the elements corresponds to the order of the face feature points defined at the featureControl for face in 2.2.15 of ISO/IEC_23005-4
NumOfBodyFeature	This field, which is only present in the binary representation, specifies the number of body feature points.
BodyFeature	Describes the 3D position of each of the body feature points detected by the camera. Note: The order of the elements corresponds to the order of the body feature points defined at the featureControl for body in 2.2.14 of ISO/IEC_23005-4.

[0601] Table 76 denotes sensed information related to an ambient noise sensor using the XML. However a program source shown in Table 76 is not limiting but only an example embodiment.

[Table 76]

```

<!--##### -->
<!--Definition of Ambient Noise Sensor type -->
<!--##### -->
<complexType name="AmbientNoiseSensorType">
  <complexContent>
    <extension base="iidl:SensedInfoBaseType">
      <attribute name="lifespan" type="float"
        use="optional"/>
      <attribute name="value" type="float"
        use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

(continued)

```

        <attribute name="unit" type="iidl:unitType"
        use="optional"/>
    </extension>
    </complexContent>
</complexType>

```

[0602] An ambient noise sensor type is a tool for describing sensed information related to the ambient noise sensor.

[0603] The ambient noise sensor type may include attributes such as a timestamp, a life span, and a value.

[0604] The timestamp denotes information on a sensing time of the ambient noise sensor.

[0605] The life span denotes information on a valid period of a command of the ambient noise sensor. For example, the life span may be a second unit.

[0606] The value denotes information on an ambient noise sensor value expressed by a unit of sound intensity, for example, dB.

[0607] Table 77 shows binary representation syntax corresponding to the sensed information related to the ambient noise sensor according to the example embodiments.

[Table 77]

AmbientNoiseSensorType{	Number of bits	Mnemonic
lifespanFlag	1	bslbf
valueFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(lifespanFlag) {		
lifespan	32	fsbf
}		
if(valueFlag) {		
value	32	fsbf
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0608] Table 78 shows descriptor components semantics of the ambient noise sensor according to the example embodiments.

[Table 78]

Names	Description
AmbientNoiseSensorType	Tool for describing sensed information with respect to an ambient noise sensor.
lifespanFlag	This field, which is only present in the binary representation, signals the presence of the life span attribute. A value of "1" means the lifespan shall be used and "0" means the lifespan shall not be used.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

(continued)

Names	Description
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
SensedInfoBaseType	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
lifespan	Describes the duration taken to measure the information based on the timestamp. :
value	Describes the sensed value of the ambient noise sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0609] Table 79 denotes sensed information related to an atmospheric pressure sensor using the XML. However, a program source shown in Table 79 is not limiting but only an example embodiment.

[Table 79]

```

<!--##### -->
<!--Definition of Atmospheric pressure Sensor type -->
<!--##### -->
<complexType name="AtmosphericPressureSensorType">
  <complexContent>
    <extension base="iidl:SensedInfoBaseType">
      <attribute name="value" type="float"
        use="optional"/>
      <attribute name=" unit" type="iidl:unitType"
        use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0610] An atmospheric pressure sensor type is a tool for describing sensed information related to the atmospheric pressure sensor.

[0611] The atmospheric pressure sensor type may include attributes such as a timestamp, a life span, and a value.

[0612] The timestamp denotes information on a sensing time of the atmospheric pressure sensor.

[0613] The life span denotes information on a valid period of a command of the atmospheric pressure sensor. For example, the life span may be a second unit.

[0614] The value denotes information on an atmospheric pressure sensor value expressed by a unit of atmospheric pressure, for example, hPa.

[0615] Table 80 shows binary representation syntax corresponding to the sensed information related to the atmospheric pressure sensor according to the example embodiments.

[Table 80]

AtmosphericPressureSensorType {	Number of bits	Mnemonic
valueFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(valueFlag) {		
value	32	fsbf
}		

(continued)

AtmosphericPressureSensorType {	Number of bits	Mnemonic
if(unitFlag) {		
unit		unitType
}		
}		

[0616] Table 81 shows descriptor components semantics of the atmospheric pressure sensor according to the example embodiments.

[Table 81]

Names	Description
AtmosphericPressureSensorType	Tool for describing sensed information with respect to an atmospheric pressure sensor.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
value	Describes the sensed value of the atmospheric pressure sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xx of ISO/IEC 23005-6 and use the binary representation defined above.

[0617] Table 82 denotes sensed information related to a velocity sensor using the XML. However, a program source shown in Table 82 is not limiting but only an example embodiment.

[Table 82]

```

<!--##### -->
  <!--Definition of Velocity Sensor type -->
  <!--##### -->
  <complexType name="VelocitySensorType">
    <complexContent>
      <extension base="iidl:SensedInfoBaseType">
        <sequence>
          <element name="velocity"
            type="mpegvct:Float3DVectorType" minOccurs="0"/>
        </sequence>
        <attribute name="timestamp" type="float"
          use="optional"/>
        <attribute name="unit"
          type="mpegvct:unitType" use="optional"/>
      </extension>
    </complexContent>
  </complexType>

```

[0618] A velocity sensor type is a tool for describing sensed information related to the velocity sensor.

[0619] The velocity sensor type may include attributes such as a timestamp, a life span, a velocity, a velocity value type, Vx, Vy, and Vz.

[0620] The timestamp denotes information on a sensing time of the velocity sensor.

[0621] The life span denotes information on a valid period of a command of the velocity sensor. For example, the life span may be a second unit.

[0622] The velocity denotes information on a velocity sensor value expressed by a unit of velocity, for example, m/s.

[0623] The velocity value type denotes a tool for indicating a 3D velocity vector.

[0624] The Vx denotes information on an x-axis value of the velocity sensor.

[0625] The Vy denotes information on a y-axis value of the velocity sensor.

[0626] The Vz denotes information on a z-axis value of the velocity sensor.

[0627] Table 83 shows binary representation syntax corresponding to the sensed information related to the velocity sensor according to the example embodiments.

[Table 83]

VelocitySensorType {	Number of bits	Mnemonic
velocity Flag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(velocityFlag) {		
velocity		Float3DVectorType
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0628] Table 84 shows descriptor components semantics of the velocity sensor according to the example embodiments.

[Table 84]

Names	Description
VelocitySensorType	Tool for describing sensed information with respect to a velocity sensor.
velocityFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
velocity	Describes the sensed value of the velocity sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0629] Table 85 denotes sensed information related to an angular velocity sensor using the XML. However, a program source shown in Table 85 is not limiting but only an example embodiment.

[Table 85]

```

<!--##### -->
<!--Definition of Angular Velocity Sensor type -->
<!--##### -->
5  <complexType name="AngularVelocitySensorType">
    <complexContent>
        <extension base="iidl: SensedInfoBaseType">
            <sequence>
                <element name="AngularVelocity"
10                type="mpegvct:Float3DVectorType" minOccurs="0"/>
            </sequence>
            <attribute name="timestamp" type="float"
                use="optional"/>
            <attribute name="unit"
15                type="mpegvct:unitType" use="optional"/>
        </extension>
    </complexContent>
</complexType>

```

[0630] An angular velocity sensor type is a tool for describing sensed information related to the angular velocity sensor.

[0631] The angular velocity sensor type may include attributes such as a timestamp, a life span, an angular velocity, an angular velocity value type, AVx, AVy, and AVz.

[0632] The timestamp denotes information on a sensing time of the angular velocity sensor.

[0633] The life span denotes information on a valid period of a command of the angular velocity sensor. For example, the life span may be a second unit.

[0634] The angular velocity denotes information on an angular velocity sensor value expressed by a unit of angular velocity, for example, radian.

[0635] The angular velocity value type denotes a tool for indicating a 3D angular velocity vector.

[0636] The AVx denotes information on a value of an x-axis rotation angular velocity of the angular velocity sensor.

[0637] The AVy denotes information on a value of a y-axis rotation angular velocity of the angular velocity sensor.

[0638] The AVz denotes information on a value of a z-axis rotation angular velocity of the angular velocity sensor.

[0639] Table 86 shows binary representation syntax corresponding to the sensed information related to the angular velocity sensor according to the example embodiments.

[Table 86]

AngularVelocitySensorType {	Number of bits	Mnemonic
angularvelocity Flag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(angularvelocityFlag) {		
angularvelocity		Float3DVectorType
}		
if(unitFlag) {		
Unit		unitType
}		
}		

[0640] Table 87 shows descriptor components semantics of the angular velocity sensor according to the example embodiments.

[Table 87]

Names	Description
AngularVelocitySensorType	Tool for describing sensed information with respect to an angular velocity sensor
angularvelocityFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
angularvelocity	Describes the sensed value of the angular velocity sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0641] Table 88 denotes sensed information related to an angular acceleration sensor using the XML. However, a program source shown in Table 88 is not limiting but only an example embodiment.

[Table 88]

```

5      <!--##### -->

      <!--Definition of Angular Acceleration Sensor type -->

10     <!--##### -->

      <complexType name="AngularAccelerationSensorType">

          <complexContent>

15              <extension base="iidl:SensedInfoBaseType">

                  <sequence>

20                      <element

                          name="AngularAcceleration" type="mpegvct:Float3DVectorType" minOccurs="0"/>

25                      </sequence>

                          <attribute name="timestamp" type="float"

30                          use="optional"/>

                              <attribute name="unit"

35                              type="mpegvct:unitType" use="optional"/>

                                  </extension>

                                      </complexContent>

40                                      </complexType>

```

[0642] An angular acceleration sensor type is a tool for describing sensed information related to the angular acceleration sensor.

[0643] The angular acceleration sensor type may include attributes such as a timestamp, a life span, an angular acceleration, an angular acceleration value type, an AAx, an AAy, and an AAz.

[0644] The timestamp denotes information on a sensing time of the angular acceleration sensor.

[0645] The life span denotes information on a valid period of a command of the angular acceleration sensor. For example, the life span may be a second unit.

[0646] The angular acceleration denotes information on an angular acceleration sensor value expressed by a unit of angular acceleration, for example, radian/s².

[0647] The angular acceleration value type denotes a tool for indicating a 3D angular acceleration vector.

[0648] The AAx denotes information on an x-axis value of the angular acceleration sensor.

[0649] The AAy denotes information on a y-axis value of the angular acceleration sensor.

[0650] The AAz denotes information on a z-axis value of the angular acceleration sensor.

[0651] Table 89 shows binary representation syntax corresponding to the sensed information related to the angular acceleration sensor according to the example embodiments.

[Table 89]

AngularAccelerationSensorType{	Number of bits	Mnemonic
angularaccelerationFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(angularaccelerationFlag) {		
angularacceleration		Float3DVectorType
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0652] Table 90 shows descriptor components semantics of the angular acceleration sensor according to the example embodiments.

[Table 90]

Names	Description
AngularAccelerationSensorType	Tool for describing sensed information with respect to an angular acceleration sensor
angularaccelerationFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
SensedInfoBaseType	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
angularacceleration	Describes the sensed value of the angular acceleration sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0653] Table 91 denotes sensed information related to a force sensor using the XML. However, a program source shown in Table 91 is not limiting but only an example embodiment.

[Table 91]

```

<!--##### -->
<!--Definition of Force Sensor type -->
<!--##### -->
<complexType name="ForceSensorType">
  <complexContent>
    <extension base="iidl: SensedInfoBaseType">
      <sequence>
        <element name="force"
          type="mpegvct:Float3DVectorType" minOccurs="0"/>
      </sequence>
      <attribute name="timestamp" type="float"
        use="optional"/>
      <attribute name="unit"
        type="mpegvct:unitType" use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0654] A force sensor type is a tool for describing sensed information related to the force sensor.

[0655] The force sensor type may include attributes such as a timestamp, a life span, a force, a force value type, FSx, FSy, and FSz.

[0656] The timestamp denotes information on a sensing time of the force sensor.

[0657] The life span denotes information on a valid period of a command of the force sensor. For example, the life span may be a second unit.

[0658] The force denotes information on a force sensor value expressed by a unit of force, for example, N.

[0659] The force value type denotes a tool for indicating a 3D force vector.

[0660] The FSx denotes information on an x-axis force value of the force sensor.

[0661] The FSy denotes information on a y-axis force value of the force sensor.

[0662] The FSz denotes information on a z-axis force value of the force sensor.

[0663] Table 92 shows binary representation syntax corresponding to the sensed information related to the force sensor according to the example embodiments.

[Table 92]

ForceSensorType{	Number of bits	Mnemonic
forceFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(forceFlag) {		
force		Float3DVectorType
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0664] Table 93 shows descriptor components semantics of the force sensor according to the example embodiments.

[Table 93]

Names	Description
ForceSensorType	Tool for describing sensed information with respect to a force sensor

(continued)

Names	Description
forceFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
SensedInfoBaseType	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
force	Describes the sensed value of the force sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0665] Table 94 denotes sensed information related to a torque sensor using the XML. However, a program source shown in Table 94 is not limiting but only an example embodiment.

[Table 94]

```
<!--#####-->
```

```
<!--Definition of Torque Sensor type -->
```

```
<!--#####-->
```

```
<complexType name="TorqueSensorType">
```

```
  <complexContent>
```

```
    <extension base="iidl:SensedInfoBaseType">
```

```
      <sequence>
```

```
        <element name="Torque"
```

```
          type="mpegvct:Float3DVectorType" minOccurs="0"/>
```

</sequence>

<attribute name="timestamp" type="float"
use="optional"/>

<attribute name="unit"
type="mpegvct:unitType" use="optional"/>

</extension>

</complexContent>

</complexType>

[0666] A torque sensor type is a tool for describing sensed information related to the torque sensor.

[0667] The torque sensor type may include attributes such as a timestamp, a life span, a torque, a torque value type, TSx, TSy, and TSz.

[0668] The timestamp denotes information on a sensing time of the torque sensor.

[0669] The life span denotes information on a valid period of a command of the torque sensor. For example, the life span may be a second unit.

[0670] The torque denotes information on a torque sensor value expressed by a unit of torque, for example, N-mm.

[0671] The torque value type denotes a tool for indicating a 3D torque vector.

[0672] The TSx denotes information on an x-axis torque value of the torque sensor.

[0673] The TSy denotes information on a y-axis torque value of the torque sensor.

[0674] The TSz denotes information on a z-axis torque value of the force sensor.

[0675] Table 95 shows binary representation syntax corresponding to the sensed information related to the torque sensor according to the example embodiments.

[Table 95]

TorqueSensorType {	Number of bits	Mnemonic
TorqueFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(torqueFlag) {		
torque		Float3 D V ectorType
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0676] Table 96 shows de criptor components semantics of the torque sensor according to the example embodiments

[Table 96]

Names	Description
TorqueSensorType	Tool for describing sensed information with respect to a torque sensor
torqueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of " 1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of " 1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
SensedInfoBaseType	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
torque	Describes the sensed value of the torque sensor in 3D with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0677] Table 97 denotes sensed information related to a pressure sensor using the XML. However, a program source shown in Table 97 is not limiting but only an example embodiment.

[Table 97]

```

<!--##### -->
<!--Definition of Pressure Sensor type -->
<!--##### -->
<complexType name="PressureSensorType">
  <complexContent>
    <extension base="iidl: SensedInfoBaseType">
      <attribute name="timestamp" type="float"
        use="optional"/>
      <attribute name="value" type="float"
        use="optional"/>
      <attribute name="unit"
        type="mpegvct:unitType" use="optional"/>
    </extension>
  </complexContent>
</complexType>

```

[0678] A pressure sensor type is a tool for describing sensed information related to the pressure sensor.

[0679] The pressure sensor type may include attributes such as a timestamp, a life span, and a value.

[0680] The timestamp denotes information on a sensing time of the pressure sensor.

[0681] The life span denotes information on a valid period of a command of the pressure sensor. For example, the life span may be a second unit.

[0682] The value denotes information on a pressure sensor value expressed by a unit of pressure, for example, N/mm².

[0683] Table 98 shows binary representation syntax corresponding to the sensed information related to the torque pressure according to the example embodiments.

[Table 98]

PressureSensorType{	Number of bits	Mnemonic
valueFlag	1	bslbf
unitFlag	1	bslbf
SensedInfoBaseType		SensedInfoBaseTypeType
if(valueFlag) {		

(continued)

PressureSensorType{	Number of bits	Mnemonic
value	32	fsbf
}		
if(unitFlag) {		
unit		unitType
}		
}		

[0684] Table 99 shows descriptor components semantics of the pressure sensor according to the example embodiments.

[Table 99]

Names	Description
PressureSensorType	Tool for describing sensed information with respect to a pressure sensor.
valueFlag	This field, which is only present in the binary representation, signals the presence of sensor value attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of unit attribute. A value of "1" means the user-defined unit shall be used and "0" means the user-defined unit shall not be used.
SensedInfoBaseType	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
value	Describes the sensed value of the pressure sensor with respect to the default unit if the unit is not defined. Otherwise, use the unit type defined in the sensor capability.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitCS defined in xxx of ISO/IEC 23005-6 and use the binary representation defined above.

[0685] Table 100 may be a program representing a timestamp type using the XML. However, the program source shown in Table 100 is not limiting but only an example embodiment.

[Table 100]

```

<complexType name="TimeStampType" abstract="true"/>
<complexType name="AbsoluteTimeType">
  <complexContent>
    <extension base="ct:TimeStampType">
      <attribute name="absTimeScheme" type="string" use="optional"/>
      <attribute name="absTime" type="string"/>
    </extension>
  </complexContent>
</complexType>

```

(continued)

```

</complexType>
<complexType name="ClockTickTimeType">
  <complexContent>
    <extension base="ct:TimeStampType">
      <attribute name="timeScale" type="unsignedInt" use="optional"/>
      <attribute name="pts" type="nonNegativeInteger"/>
    </extension>
  </complexContent>
</complexType>
<complexType name="ClockTickTimeDeltaType">
  <complexContent>
    <extension base="ct:TimeStampType">
      <attribute name="timeScale" type="unsignedInt" use="optional"/>
      <attribute name="ptsDelta" type="unsignedInt"/>
    </extension>
  </complexContent>
</complexType>

```

[0686] Table 101 shows binary representation syntax related to the timestamp type according to the example embodiments.

[Table 101]

TimeStampType {		
TimeStampSelect	2	bslbf
if(TimeStampSelect==00) {		
AbsoluteTimeStamp		AbsoluteTimeStampType
} else if (TimeStampSelect==01){		
ClockTickTimeStamp		ClockTickTimeStampType
} else if (TimeStampSelect=10) {		
ClockTickTimeDeltaStamp		ClockTickTimeDeltaStampType
}		
}		
AbsoluteTimeStampType {	Number of bits	Mnemonic
absTimeSchemeFlag	1	bslbf
if(absTimeSchemeFlag) {		
AbsTimeSchemeLength		vluimsbf5
absTimeScheme	8* AbsTimeSchemeLength	bslbf
}		
AbsTimeLength		vluimsbf5
absTime	8* AbsTimeLength	bslbf
}		
ClockTickTimeType {	Number of bits	Mnemonic
timeScaleFlag	1	bslbf
if(timeScaleFlag) {		

(continued)

	ClockTickTimeType {	Number of bits	Mnemonic
5	timeScale	32	uimsbf
	}		
	pts		vluimsbf5
10	}		
	ClockTickTimeDeltaType {	Number of bits	Mnemonic
	timeScaleFlag	1	bslbf
15	if(timeScaleFlag) {		
	timeScale	32	uimsbf
	}		
	ptsDelta	32	uimsbf
20	}		

[0687] Table 101-2 shows descriptor components semantics of the timestamp type according to the example embodiments.

[Table 101-2]

	Names	Description
30	TimeStampType	Tools for Providing the timing information for the device command to be executed. As defined in Part 6 of ISO/IEC 23005, there is a choice of selection among three timing schemes, which are absolute time, clock tick time, and delta of clock tick time
35	TimeStampSelect	This field, which is only present in the binary representation, describes which time stamp scheme shall be used. "00" means that the absolute time stamp type shall be used, "01" means that the clock tick time stamp type shall be used, and "10" means that the clock tick time delta stamp type shall be used.
	AbsoluteTimeStamp	The absolute time stamp is defined in A.2.3 of ISO/IEC 23005-6.
	ClockTickTimeStamp	The clock tick time stamp is defined in A.2.3 of ISO/IEC 23005-6.
40	ClockTickTimeDeltaStamp	The clock tick time delta stamp, which value is the time delta between the present and the past time, is defined in A.2.3 of ISO/IEC 23005-6.
	AbsoluteTimeStampType	Tools for Providing the absolute timing information for the sensed information.
	ClockTickTime Type	Tools for Providing the clock tick timing information for the sensed information.
45	ClockTickTimeDeltaType	Tools for Providing the delta of clock tick timing information for the sensed information.
	absTimeSchemeFlag	This field, which is only present in the binary representation, describes whether an optional absolute time stamp scheme shall be selected or not.
	AbsTimeSchemeLength	This field, which is only present in the binary representation, describes the length of the absolute time scheme.
50	absTimeScheme	Specifies the absolute time scheme used in the format of string. See the annex C of ISO/IEC 21000-17:2006 for examples of time schemes syntax. If mpeg-7 time scheme is used, the value for this field shall be "mp7t".
55	AbsTimeLength	This field, which is only present in the binary representation, describes the length of the absolute time element.
	absTime	Provides value of time information in the format defined in the absolute time scheme specified in absTimeScheme attribute.

(continued)

Names	Description
timeScale Flag	This field, which is only present in the binary representation, describes whether a time scale element shall be used or not.
timeScale	An optional attribute to provide the time scale for the clock tick, i.e. the number of clock ticks per second.
pts	Specifies the number of clock ticks from the origin of the target device.
timeScale Flag	This field, which is only present in the binary representation, describes whether a time scale element shall be used or not.
timeScale	An optional attribute to provide the time scale for the clock tick, i.e. the number of clock ticks per second.
ptsDelta	Specifies the number of clock ticks from the time point specified by the last timing information provided.

[0688] FIG. 19 is a flowchart illustrating a virtual world processing method according to example embodiments.

[0689] Referring to FIG. 19, the virtual world processing method may store sensor capability related to capability of a sensor in operation 1110.

[0690] In operation 1120, a first value received from the sensor may be determined based on the sensor capability and a second value corresponding to the first value may be transmitted to the virtual world.

[0691] Depending on embodiments, the sensor capability may include a maximum value and a minimum value measurable by the sensor. When the first value is less than or equal to the maximum value and greater than or equal to the minimum value, the virtual world processing method may transmit the second value corresponding to the first value to the virtual world.

[0692] Depending on embodiments, the sensor capability may include a unit of the first value measured by the sensor. In addition, the sensor capability may include an offset value added to the first value measured by the sensor to obtain an absolute value. The sensor capability may further include a number of values measurable by the sensor. The sensor capability may further include a minimum input value required for the sensor to measure an output value. The sensor capability may further include an SNR of the sensor. The sensor capability may further include an error of the sensor. Additionally, the sensor capability may further include a position of the sensor.

[0693] The virtual world processing method may further include an operation (not shown) of storing a sensor adaptation preference for manipulation of the first value received from the sensor. The operation of transmitting the first value may include generating a third value from the first value based on the sensor capability and generating the second value from the third value based on the sensor adaptation preference.

[0694] Depending on embodiments, the sensor adaptation preference may include information on a method of applying the sensor adaptation preference to the first value. The sensor adaptation preference may further include information on whether to activate the sensor in the virtual world. The sensor adaptation preference may further include a unit of the second value used in the virtual world. The sensor adaptation preference may further include a maximum value and a minimum value of the second value used in the virtual world. In addition, the sensor adaptation preference may further include a number of the second values used in the virtual world.

[0695] FIG 20 illustrates a flowchart of a virtual world processing method according to other example embodiments.

[0696] Referring to FIG. 20, the virtual world processing method may perform initial setting to be input with information of a real world from a sensor in operation 1210. Depending on embodiments, the initial setting may be an operation of activating the sensor.

[0697] The virtual world processing method may store sensor capability as information on capability of the sensor and a sensor adaptation preference as information for manipulation of a value received from the sensor, in operation 1220.

[0698] The virtual world processing method may measure information on a motion, state, intention, shape, and the like of a user of the real world through the sensor, in operation 1230. When the sensor is incapable of measuring the information, operation 1230 may be repeated until the information is measured.

[0699] When the information is measured through the sensor, preprocessing with respect to the information may be performed in operation 1240.

[0700] Also, the virtual world processing method may control the sensor using sensed information which is a command for controlling the sensor in operation 1250.

[0701] An adaptation RV may determine a first value received from the sensor based on the sensor capability and transmit a second value corresponding to the first value to a virtual world, in operation 1260. Depending on embodiments,

a third value may be generated from the first value based on the sensor capability, the second value may be generated from the third value based on the sensor adaptation preference, and the second value may be transmitted to the virtual world.

[0702] FIG. 21 illustrates an operation of using a virtual world processing apparatus according to example embodiments.

[0703] Referring to FIG. 21, a user 1310 of a real world may input his or her intention through a sensor 1301. Depending on embodiments, the sensor 1301 may include a motion sensor configured to measure a motion of the user 1310 of the real world, and remote pointers attached to ends of arms and legs of the user 1310 and configured to measure directions and positions indicated by the ends of the arms and legs.

[0704] A sensor signal may be transmitted to the virtual world processing apparatus, the sensor signal which includes CI 1302 related to an arm opening motion, a still standing state, positions of hands and feet, an open angle of a hand, and the like of the user 1310.

[0705] Depending on embodiments, the CI 1302 may include sensor capability, a sensor adaptation preference, and sensed information.

[0706] Depending on embodiments, the CI 1302 may include position information of the arms and the legs of the user 1310, expressed by X_{real} , Y_{real} , and Z_{real} denoting values on an x-axis, y-axis, and z-axis and $\Theta_{X\text{real}}$, $\Theta_{Y\text{real}}$, and $\Theta_{Z\text{real}}$ denoting angles with respect to the x-axis, y-axis, and z-axis.

[0707] The virtual world processing apparatus may include an RV engine 1320. The RV engine 1320 may convert information of the real world to information applicable to a virtual world, using the CI 1302 included in the sensor signal.

[0708] Depending on embodiments, the RV engine 1320 may convert VWI 1303 using the CI 1302.

[0709] The VWI 1303 denotes information on the virtual world. For example, the VWI 1303 may include information on an object of the virtual world or elements constituting the object.

[0710] The VWI 1303 may include virtual world object information 1304 and avatar information 1305.

[0711] The virtual world object information 1304 denotes information on the object of the virtual world. The virtual world object information 1304 may include an object ID denoting ID information for recognizing identity of the object of the virtual world, and an object control and scale denoting information for controlling a state, size, and the like of the object of the virtual world.

[0712] Depending on embodiments, the virtual world processing apparatus may control the virtual world object information 1304 and the avatar information 1305 by a control command. The control command may include commands such as generation, disappearance, copy, and the like. The virtual world processing apparatus may generate the commands by selecting information to be manipulated from the virtual world object information 1304 and the avatar information 1305, along with the control command, and designating an ID corresponding to the selected information.

[0713] Table 102 denotes a method of constructing the control command using an XML. However, a program source shown in Table 82 is not limiting but only an example embodiment.

[Table 102]

```
<!--#####-->
<!-- Definition of Control command for Avatar and virtual object -->
<!--#####-->
```

(continued)

```

5      <complexType name="ControlCommand">
          <SimpleContent>
              <attribute name="command" type="scdv:commandType"
3              use="required"/>
              <attribute name="Object" type="scdv:ObjectType"
                  use="required" />
              <attribute name="ObjectID" type="ID" use="optional"/>
          </SimpleContent>
10      </complexType>
      <simpleType name="commandType">
          <restriction base="string">
              <enumeration value="Create"/>
              <enumeration value="Remove"/>
15              <enumeration value="Copy"/>
          </restriction>
      </simpleType>
      <simpleType name="ObjectType">
          <restriction base="string">
              <enumeration value="Avatar"/>
20              <enumeration value="VirtualObject"/>
          </restriction>
      </simpleType>

```

25 **[0714]** The RV engine 1320 may convert the VWI 1303 by applying information on the arm opening motion, the still standing state, the positions of hands and feet, the open angle of a hand, and the like, using the CI 1302.

[0715] The RV engine 1320 may transmit information 1306 on the converted VWI to the virtual world. The information 1306 on the converted VWI may include position information of arms and legs of an avatar of the virtual world, expressed by X_{virtual} , Y_{virtual} , and Z_{virtual} denoting values on the x-axis, y-axis, and z-axis and $\Theta_{X_{\text{virtual}}}$, $\Theta_{Y_{\text{virtual}}}$, and $\Theta_{Z_{\text{virtual}}}$ denoting angles with respect to the x-axis, y-axis, and z-axis. In addition, the information 1306 may include information on a size of the object of the virtual world, expressed by a scale(s,d,h) virtual denoting a width value, a height value, and a depth value of the object.

[0716] Depending on embodiments, in a virtual world 1330 of before transmission of the information 1306, the avatar is holding the object. In a virtual world 1340 of after transmission of the information 1306, since the arm opening motion, the still standing state, the positions of hands and feet, the open angle of a hand, and the like are reflected, the avatar of the virtual world may scale up the object.

[0717] That is, when the user 1310 of the real world makes a motion of holding and enlarging the object, the CI 1302 related to the arm opening motion, the still standing state, the positions of hands and feet, the open angle of a hand, and the like may be generated through the sensor 1301. Also, the RV engine 1320 may convert the CI 1302 related to the user 1310 of the virtual world, which is data measured in the real world, to the information applicable to the virtual world. The converted information may be applied to a structure of information related to the avatar and the object of the virtual world. Therefore, the motion of holding and enlarging the object may be reflected to the avatar, and the object may be enlarged.

[0718] Example embodiments include computer-readable media including program instructions to implement various operations embodied by a computer. The media may also include, alone or in combination with the program instructions, data files, data structures, tables, and the like. The media and program instructions may be those specially designed and constructed for the purposes of example embodiments, or they may be of the kind well known and available to those having skill in the computer software arts. Examples of computer-readable media include magnetic media such as hard disks, floppy disks, and magnetic tape; optical media such as CD ROM disks; magneto-optical media such as floptical disks; and hardware devices that are specially configured to store and perform program instructions, such as read-only memory devices (ROM) and random access memory (RAM). Examples of program instructions include both machine code, such as produced by a compiler, and files containing higher level code that may be executed by the computer using an interpreter. The described hardware devices may be configured to act as one or more software module: in order to perform the operations of the above-described example embodiments, or vice versa.

[0719] Although a few example embodiments have been shown and described, the present disclosure is not limited to the described example embodiments. Instead, it would be appreciated by those skilled in the art that changes may be made to these example embodiments without departing from the principles of the disclosure, the scope of which is defined by the claims.

Claims

1. A virtual world processing apparatus (300, 350) comprising:

a sensor (250, 271, 275, 281, 370) to encode information relating to sensor capability (371) into first metadata, wherein the sensor (250, 271, 275, 281, 370) is configured to collect sensor data (372) from the real world (210), to encode the collected sensor data (372) into first data and to transmit the first data and the first metadata to an adaptation real world to virtual world, RV, unit (255);
 an actuator (288, 295, 299);
 an adaptation virtual world to real world, VR, unit (260) configured to encode information relating to a virtual world (240, 265, 380, 1330, 1340) comprising virtual world object characteristics into second data, to transmit the second data to the actuator (288, 295, 299) for actuating based upon the information relating to the virtual world (240, 265, 380, 1330, 1340) encoded in the second data, and to transmit the second data to the adaptation RV unit (255);
 the adaptation RV unit (255) configured to receive the first data, the first metadata and the second data, and to generate information that is to be applied to the virtual world (240, 265, 380, 1330, 1340) and corresponds to the virtual world object characteristics, based on the first metadata, the first data and the second data, and to encode the generated information into third data; and
 an adaptation RV/NR unit (230) configured to receive the third data and to transmit the third data to the virtual world;
 wherein the adaptation RV unit (255) is configured to transmit the third data to the adaptation RV/NR unit (230), wherein the adaptation RV/VR unit (230) is configured to obtain attributes of an object of the virtual world (265) by decoding the third data and to apply the obtained attributes to the virtual world (265),
 wherein the information relating to sensor capability (371) comprises:

a unit of a value (601) sensed by the sensor;
 a maximum value (602) that the sensor can provide;
 a minimum value (603) that the sensor can provide;
 a number of value locations (604) added to a base value in order to get to a specific absolute value;
 a number of value levels (605) that the sensor device can provide in between the maximum and the minimum value;
 a minimum magnitude (606) of sensor input signal required to produce a specified sensor output signal; and
 a signal to noise ratio of the sensor.

2. The virtual world processing apparatus of claim 1, wherein the sensor (250, 271, 275, 281, 370) is configured to generate the first metadata by encoding the information relating to sensor capability into a binary format, and to transmit the binary-encoded first metadata to the adaptation RV unit (255).

3. The virtual world processing apparatus of claim 2, wherein the binary-encoded first metadata comprises binary encoding syntax, a number of bits of attributes of the binary encoding syntax, and a mnemonic of the attributes.

4. The virtual world processing apparatus of any of claims 1-3, wherein the sensor (250, 271, 275, 281, 370) is configured to generate the first metadata by encoding the information relating to sensor capability into an extensible markup language (XML) format, and to transmit the XML-encoded first metadata to the adaptation RV unit (255).

5. The virtual world processing apparatus of any of claims 1-4, wherein the sensor (250, 271, 275, 281, 370) is configured to generate the first metadata by encoding the information relating to sensor capability into an XML format and encoding the XML-encoded data into a binary format, and to transmit the binary-encoded first metadata to the adaptation RV unit (255).

6. The virtual world processing apparatus of any of claim 1-5, wherein the adaptation VR unit is configured to generate the second data by encoding the information on the virtual world (240, 265, 380, 1330, 1340) into a binary format, and to transmit the binary-encoded second data to the adaptation RV unit (255).

7. The virtual world processing apparatus of claim 6, wherein the binary-encoded second data comprises binary encoding syntax, a number of bits of attributes of the binary encoding syntax, and a mnemonic of the attributes.

8. The virtual world processing apparatus of any of claim 1-7, wherein the adaptation VR unit is configured to generate

the second data by encoding the information relating to the virtual world (240, 265, 380, 1330, 1340) into an XML format, and to transmit the XML-encoded second data to the adaptation RV unit (255).

9. The virtual world processing apparatus of any of claims 1-8, wherein the adaptation VR unit is configured to generate the second data by encoding the information relating to the virtual world (240, 265, 380, 1330, 1340) into an XML format and encoding the XML-encoded data to a binary format, and to transmit the binary-encoded second data to the adaptation RV unit (255).

10. The virtual world processing apparatus of any of claims 1-9, wherein the sensor (250, 271, 275, 281, 370) is configured to generate the first data by encoding the collected sensor data (372) into an extensible markup language (XML) format, and encoding the encoded sensor data (372) into a binary format, and to transmit the first data, encoded into the binary format, to the adaptation RV unit (255), wherein the sensor data (372) is sensed information, sensed by the sensor (250, 271, 275, 281, 370), relating to at least one of movement, state, and shape of a user, and wherein the information relating to the sensor capability includes at least a minimum value and a maximum value.

11. A virtual world processing method for a virtual world processing apparatus (300, 350) comprising a sensor (250, 271, 275, 281, 370), an actuator (288, 295, 299) an adaptation virtual world to real world, VR, unit (260), an adaptation real world to virtual world, RV, unit (255), and an adaptation RV/NR unit (230), the method comprising:

encoding, by a sensor (250, 271, 275, 281, 370), information relating to sensor capability into first metadata;
collecting, by the sensor (250, 271, 275, 281, 370), sensor data (372) from the real world (210);
encoding, by the sensor (250, 271, 275, 281, 370), the collected sensor data (372) into first data;
transmitting, by the sensor (250, 271, 275, 281, 370), the first data and the first metadata to the adaptation RV unit (255);
encoding, by the adaptation VR unit (260), information relating to a virtual world (240, 265, 380, 1330, 1340) comprising virtual world object characteristics into second data;
transmitting, by the adaptation RV/NR unit (230), the second data to the actuator (288, 295, 299) for actuating based upon the information relating to the virtual world (240, 265, 380, 1330, 1340) encoded in the second data;
transmitting, by the adaptation RV/NR unit (230) the second data to the adaptation RV unit (255);
receiving, by the adaptation RV unit (255), the first data, the first metadata and the second data;
generating, by the adaptation RV unit (255), information that is to be applied to the virtual world (240, 265, 380, 1330, 1340) and corresponds to the virtual world object characteristics, based on the first metadata, the first data, and the second data;
encoding, by the adaptation RV unit (255) the generated information into third data;
transmitting, by the adaptation RV unit (255), the third data to the adaptation VR unit (260);
obtaining, by the adaptation RV/NR unit (230), attributes of an object of the virtual world (265) by decoding the third data; and
applying, by the adaptation RV/NR unit (230), the obtained attributes to the virtual world (265), wherein the information relating to sensor capability (371) comprises:

a unit of a value (601) sensed by the sensor;
a maximum value (602) that the sensor can provide;
a minimum value (603) that the sensor can provide;
a number of value locations (604) added to a base value in order to get to a specific absolute value;
a number of value levels (605) that the sensor can provide in between the maximum and the minimum value;
the minimum magnitude (606) of sensor input signal required to produce a specified sensor output signal; and
a signal to noise ratio of the sensor.

12. The virtual world processing method of claim 11, wherein the encoding of the information relating to sensor capability into the first metadata comprises generating the first metadata by encoding the information relating to sensor capability into a binary format.

13. A non-transitory computer-readable recording medium storing a program to cause a virtual world processing apparatus according to any of claim 1 to 10 to implement the method of claim 11 or 12.

Patentansprüche

1. Vorrichtung (300, 350) zur Verarbeitung einer virtuellen Welt, die Folgendes umfasst:

einen Sensor (250, 271, 275, 281, 370), um Informationen im Zusammenhang mit einer Sensorfähigkeit (371) in erste Metadaten zu codieren, wobei der Sensor (250, 271, 275, 281, 370) dazu konfiguriert ist, Sensordaten (372) aus der wirklichen Welt (210) zu sammeln, die gesammelten Sensordaten (372) in erste Daten zu codieren, und die ersten Daten und die ersten Metadaten an eine Einheit (255) zur Adaption der wirklichen Welt (Real World) in eine virtuelle Welt (Virtual World) (RV-Adaptionseinheit) zu übertragen;
 ein Stellglied (288, 295, 299);
 eine Einheit (260) zur Adaption der virtuellen Welt in eine wirkliche Welt (VR-Adaptionseinheit), die dazu konfiguriert ist, Informationen im Zusammenhang mit einer virtuellen Welt (240, 265, 380, 1330, 1340), einschließlich Eigenschaften eines Objekts der virtuellen Welt, in zweite Daten zu codieren, die zweiten Daten an das Stellglied (288, 295, 299) zu übertragen für eine Betätigung basierend auf den Informationen im Zusammenhang mit der virtuellen Welt (240, 265, 380, 1330, 1340), die in die zweiten Daten codiert wurden, und die zweiten Daten an die RV-Adaptionseinheit (255) zu übertragen;
 die RV-Adaptionseinheit (255), die dazu konfiguriert ist, die ersten Daten, die ersten Metadaten und die zweiten Daten zu empfangen, und basierend auf den ersten Metadaten, den ersten Daten und den zweiten Daten Informationen zu erzeugen, die auf die virtuelle Welt (240, 265, 380, 1330, 1340) angewendet werden sollen und den Eigenschaften des Objekts der virtuellen Welt entsprechen, und die erzeugten Informationen in dritte Metadaten zu codieren; und
 eine RV/VR-Adaptionseinheit (230), die dazu konfiguriert ist, die dritten Daten zu empfangen und die dritten Daten an die virtuelle Welt zu senden;
 wobei die RV-Adaptionseinheit (255) dazu konfiguriert ist, die dritten Daten an die RV/VR-Adaptionseinheit (230) zu übertragen,
 wobei die RV/VR-Adaptionseinheit (230) dazu konfiguriert ist, Attribute eines Objekts der virtuellen Welt (265) durch Decodieren der dritten Daten zu erhalten, und die erhaltenen Attribute auf die virtuelle Welt (265) anzuwenden,
 wobei die Informationen im Zusammenhang mit der Sensorfähigkeit (371) Folgendes umfassen:
 die Einheit eines von dem Sensor erfassten Wertes (601);
 einen Maximalwert (602), den der Sensor bereitstellen kann;
 einen Minimalwert (603), den der Sensor bereitstellen kann;
 eine Anzahl von Wertepositionen (604), die zu einem Basiswert addiert wurde, um einen spezifischen Absolutwert zu erhalten;
 eine Anzahl von Werteniveaus (605) zwischen dem Maximalwert und dem Minimalwert, die der Sensor bereitstellen kann;
 eine minimale Größe (606) eines Sensoreingangssignals, die erforderlich ist, um ein spezifisches Sensorausgangssignal zu erzeugen; und
 ein Signal-Rauschen-Verhältnis des Sensors.

2. Vorrichtung zur Verarbeitung einer virtuellen Welt nach Anspruch 1, wobei der Sensor (250, 271, 275, 281, 370) dazu konfiguriert ist, die ersten Metadaten durch Codieren der Informationen im Zusammenhang mit der Sensorfähigkeit in ein binäres Format zu erzeugen, und die binär codierten ersten Metadaten an die RV-Adaptionseinheit (255) zu übertragen.

3. Vorrichtung zur Verarbeitung einer virtuellen Welt nach Anspruch 2, wobei die binär codierten ersten Metadaten eine binäre Codierungssyntax, eine Anzahl von Attributbits der binären Codierungssyntax und eine Mnemonik der Attribute umfassen.

4. Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 3, wobei der Sensor (250, 271, 275, 281, 370) dazu konfiguriert ist, die ersten Metadaten durch Codieren der Informationen im Zusammenhang mit der Sensorfähigkeit in ein Extensible-Markup-Language-Format (XML-Format) zu erzeugen, und die XML-codierten ersten Metadaten an die RV-Adaptionseinheit (255) zu übertragen.

5. Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 4, wobei der Sensor (250, 271, 275, 281, 370) dazu konfiguriert ist, die ersten Metadaten durch Codieren der Informationen im Zusammenhang mit der Sensorfähigkeit in ein XML-Format und Codieren der XML-codierten Daten in ein binäres Format zu erzeugen,

und die binär codierten ersten Metadaten an die RV-Adaptionseinheit (255) zu übertragen.

6. Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 5, wobei die VR-Adaptionseinheit dazu konfiguriert ist, die zweiten Daten durch Codieren der Informationen über die virtuelle Welt (240, 265, 380, 1330, 1340) in ein binäres Format zu erzeugen, und die binär codierten zweiten Daten an die RV-Adaptionseinheit (255) zu übertragen.
7. Vorrichtung zur Verarbeitung einer virtuellen Welt nach Anspruch 6, wobei die binär codierten zweiten Daten eine binäre Codierungssyntax, eine Anzahl von Attributbits der binären Codierungssyntax und eine Mnemonik der Attribute umfassen.
8. Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 7, wobei die VR-Adaptionseinheit dazu konfiguriert ist, die zweiten Daten durch Codieren der Informationen im Zusammenhang mit der virtuellen Welt (240, 265, 380, 1330, 1340) in ein XML-Format zu erzeugen, und die XML-codierten zweiten Daten an die RV-Adaptionseinheit (255) zu übertragen.
9. Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 8, wobei die VR-Adaptionseinheit dazu konfiguriert ist, die zweiten Daten durch Codieren der Informationen im Zusammenhang mit der virtuellen Welt (240, 265, 380, 1330, 1340) in ein XML-Format und Codieren der XML-codierten Daten in ein binäres Format zu erzeugen, und die binär codierten zweiten Daten an die RV-Adaptionseinheit (255) zu übertragen.
10. Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 9, wobei der Sensor (250, 271, 275, 281, 370) dazu konfiguriert ist, die ersten Daten durch Codieren der gesammelten Sensordaten (372) in ein Extensible-Markup-Language-Format (XML-Format) und durch Codieren der codierten Daten (372) in ein binäres Format zu erzeugen, und dazu, die in das binäre Format codierten ersten Daten an die RV-Adaptionseinheit (255) zu übertragen, wobei es sich bei den Sensordaten (372) um erfasste Informationen handelt, die von dem Sensor (250, 271, 275, 281, 370) erfasst wurden und die im Zusammenhang mit einer Bewegung, einem Status und/oder einer Form eines Benutzers stehen, und wobei die Informationen im Zusammenhang mit der Sensorfähigkeit wenigstens einen Minimalwert und einen Maximalwert enthalten.
11. Verfahren zur Verarbeitung einer virtuellen Welt für eine Vorrichtung (300, 350) zur Verarbeitung einer virtuellen Welt, die Folgendes umfasst: einen Sensor (250, 271, 275, 281, 370), ein Stellglied (288, 295, 299), eine Einheit (260) zur Adaption einer virtuellen Welt in eine wirkliche Welt (VR-Adaptionseinheit), eine Einheit (255) zur Adaption der wirklichen Welt in eine virtuelle Welt (RV-Adaptionseinheit), und eine RV/VR-Adaptionseinheit (230), wobei das Verfahren Folgendes umfasst:
 - durch einen Sensor (250, 271, 275, 281, 370) Codieren von Informationen im Zusammenhang mit einer Sensorfähigkeit in erste Metadaten;
 - durch den Sensor (250, 271, 275, 281, 370) Sammeln von Sensordaten (372) aus der wirklichen Welt (210);
 - durch den Sensor (250, 271, 275, 281, 370) Codieren der gesammelten Sensordaten (372) in erste Daten;
 - durch den Sensor (250, 271, 275, 281, 370) Übertragen der ersten Daten und der ersten Metadaten an die RV-Adaptionseinheit (255);
 - durch die VR-Adaptionseinheit (260) Codieren von Informationen im Zusammenhang mit einer virtuellen Welt (240, 265, 380, 1330, 1340), einschließlich Eigenschaften eines Objekts der virtuellen Welt, in zweite Daten;
 - durch die RV/VR-Adaptionseinheit (230) Übertragen der zweiten Daten an das Stellglied (288, 295, 299) für eine Betätigung basierend auf den Informationen im Zusammenhang mit der virtuellen Welt (240, 265, 380, 1330, 1340), die in die zweiten Daten codiert wurden;
 - durch die RV/VR-Adaptionseinheit (230) Übertragen der zweiten Daten an die RV-Adaptionseinheit (255);
 - durch die RV-Adaptionseinheit (255) Empfangen der ersten Daten, der ersten Metadaten und der zweiten Daten;
 - durch die RV-Adaptionseinheit (255) Erzeugen von Informationen, die auf die virtuelle Welt (240, 265, 380, 1330, 1340) angewendet werden sollen und den Eigenschaften des Objekts der virtuellen Welt entsprechen, basierend auf den ersten Metadaten, den ersten Daten und den zweiten Daten;
 - durch die RV-Adaptionseinheit (255) Codieren der erzeugten Informationen in dritte Daten;
 - durch die RV-Adaptionseinheit (255) Übertragen der dritten Daten an die VR-Adaptionseinheit (260);
 - durch die RV/VR-Adaptionseinheit (230) Erhalten von Attributen eines Objekts der virtuellen Welt (265) durch Decodieren der dritten Daten; und

durch die RV/VR-Adaptionseinheit (230) Anwenden der erhaltenen Attribute auf die virtuelle Welt (265), wobei die Informationen im Zusammenhang mit der Sensorfähigkeit (371) Folgendes umfassen:

die Einheit eines von dem Sensor erfassten Wertes (601);
einen Maximalwert (602), den der Sensor bereitstellen kann;
einen Minimalwert (603), den der Sensor bereitstellen kann;
eine Anzahl von Wertepositionen (604), die zu einem Basiswert addiert wurde, um einen spezifischen Absolutwert zu erhalten;
eine Anzahl von Werteniveaus (605) zwischen dem Maximalwert und dem Minimalwert, die der Sensor bereitstellen kann;
die minimale Größe (606) eines Sensoreingangssignals, die erforderlich ist, um ein spezifisches Sensorausgangssignal zu erzeugen; und
ein Signal-Rauschen-Verhältnis des Sensors.

12. Verfahren zur Verarbeitung einer virtuellen Welt nach Anspruch 11, wobei das Codieren der Informationen im Zusammenhang mit der Sensorfähigkeit in die ersten Metadaten Folgendes umfasst: Erzeugen der ersten Metadaten durch Codieren der Informationen im Zusammenhang mit der Sensorfähigkeit in ein binäres Format.

13. Nicht-flüchtiges computerlesbares Speichermedium, auf dem ein Programm gespeichert ist, das eine Vorrichtung zur Verarbeitung einer virtuellen Welt nach einem der Ansprüche 1 bis 10 veranlasst, das Verfahren nach Anspruch 11 oder 12 auszuführen.

Revendications

1. Dispositif de traitement de monde virtuel (300, 350) comprenant:

un capteur (250, 271, 275, 281, 370) destiné à encoder des informations en lien avec l'aptitude du capteur (371) en des premières métadonnées, ledit capteur (250, 271, 275, 281, 370) étant configuré pour collecter des données de capteur (372) issues du monde réel (210), à encoder les données de capteur (372) collectées en des premières données et à transmettre les premières données et les premières métadonnées à une unité d'adaptation monde réel-monde virtuel (RV) (255),

un actionneur (288, 295, 299),

une unité d'adaptation monde virtuel-monde réel (VR) (260) configurée pour encoder des informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340), dont des caractéristiques d'objet du monde virtuel, en des deuxièmes données, pour transmettre les deuxièmes données à l'actionneur (288, 295, 299) en vue d'un actionnement compte tenu des informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340) encodées en lesdites deuxièmes données, et pour transmettre les deuxièmes données à l'unité d'adaptation RV (255), l'unité d'adaptation RV (255) configurée pour recevoir les premières données, les premières métadonnées et les deuxièmes données, et pour générer des informations destinées à être appliquées au monde virtuel (240, 265, 380, 1330, 1340) et qui correspondent aux caractéristiques d'objet du monde virtuel, compte tenu des premières métadonnées, des premières données et des deuxièmes données, et pour encoder les informations générées en des troisièmes métadonnées, et

une unité d'adaptation RV/VR (230) configurée pour recevoir les troisièmes données et pour transmettre les troisièmes données au monde virtuel;

ladite unité d'adaptation RV (255) étant configurée pour transmettre les troisièmes données à l'unité d'adaptation RV/VR (230),

ladite unité d'adaptation RV/VR (230) étant configurée pour obtenir des attributs concernant un objet du monde virtuel (265) par décodage des troisièmes données et pour appliquer les attributs obtenus au monde virtuel (265), lesdites informations en lien avec l'aptitude du capteur (371) comprenant:

l'unité d'une valeur (601) détectée par le capteur,

la valeur maximale (602) que le capteur peut fournir,

la valeur minimale (603) que le capteur peut fournir,

le nombre de positions de valeur (604) ajouté à une valeur de base pour parvenir à une valeur absolue spécifique,

le nombre de niveaux de valeur (605) que le capteur peut fournir entre la valeur maximale et la valeur minimale,

la grandeur minimale (606) du signal d'entrée de capteur requise pour produire un signal de sortie de capteur spécifié, et
le rapport signal sur bruit du capteur.

- 5 **2.** Dispositif de traitement de monde virtuel selon la revendication 1, dans lequel le capteur (250, 271, 275, 281, 370) est configuré pour générer les premières métadonnées par encodage des informations en lien avec l'aptitude du capteur en un format binaire, et pour transmettre les premières métadonnées à encodage binaire à l'unité d'adaptation RV (255).
- 10 **3.** Dispositif de traitement de monde virtuel selon la revendication 2, dans lequel les premières métadonnées à encodage binaire comprennent une syntaxe d'encodage binaire, le nombre de bits d'attributs de la syntaxe d'encodage binaire et une mnémonique des attributs.
- 15 **4.** Dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 3, dans lequel le capteur (250, 271, 275, 281, 370) est configuré pour générer les premières métadonnées par encodage des informations en lien avec l'aptitude du capteur en un format XML (extensible markup language), et pour transmettre les premières métadonnées à encodage XML à l'unité d'adaptation RV (255).
- 20 **5.** Dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 4, dans lequel le capteur (250, 271, 275, 281, 370) est configuré pour générer les premières métadonnées par encodage des informations en lien avec l'aptitude du capteur en un format XML et par encodage des données à encodage XML en un format binaire, et pour transmettre les premières métadonnées à encodage binaire à l'unité d'adaptation RV (255).
- 25 **6.** Dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 5, dans lequel l'unité d'adaptation VR est configurée pour générer les deuxièmes données par encodage des informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340) en un format binaire, et pour transmettre les deuxièmes données à encodage binaire à l'unité d'adaptation RV (255).
- 30 **7.** Dispositif de traitement de monde virtuel selon la revendication 6, dans lequel les deuxièmes données à encodage binaire comprennent une syntaxe d'encodage binaire, le nombre de bits d'attributs de la syntaxe d'encodage binaire et une mnémonique des attributs.
- 35 **8.** Dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 7, dans lequel l'unité d'adaptation VR est configurée pour générer les deuxièmes données par encodage des informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340) en un format XML, et pour transmettre les deuxièmes données à encodage XML à l'unité d'adaptation RV (255).
- 40 **9.** Dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 8, dans lequel l'unité d'adaptation VR est configurée pour générer les deuxièmes données par encodage des informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340) en un format XML et par encodage des données à encodage XML en un format binaire, et pour transmettre les deuxièmes données à encodage binaire à l'unité d'adaptation RV (255).
- 45 **10.** Dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 9, dans lequel le capteur (250, 271, 275, 281, 370) est configuré pour générer les premières données par encodage des données de capteur (372) collectées en un format XML (extensible markup language), et par encodage des données de capteur (372) encodées en un format binaire, et
pour transmettre les premières données, encodées en format binaire, à l'unité d'adaptation RV (255);
lesdites données de capteur (372) sont des informations de détection, détectées par le capteur (250, 271, 275, 281, 370), en lien avec le mouvement, l'état et/ou la forme d'un utilisateur, et
50 lesdites informations en lien avec l'aptitude du capteur comprennent au moins une valeur minimale et une valeur maximale.
- 55 **11.** Procédé de traitement de monde virtuel pour un dispositif de traitement de monde virtuel (300, 350) comprenant un capteur (250, 271, 275, 281, 370), un actionneur (288, 295, 299), une unité d'adaptation monde virtuel-monde réel (VR) (260), une unité d'adaptation monde réel-monde virtuel (RV) (255), et une unité d'adaptation RV/VR (230), le procédé comprenant:

l'encodage, par un capteur (250, 271, 275, 281, 370), d'informations en lien avec l'aptitude du capteur en des

premières métadonnées,

la collecte, par le capteur (250, 271, 275, 281, 370), de données de capteur (372) issues du monde réel (210),
l'encodage, par le capteur (250, 271, 275, 281, 370), des données de capteur (372) collectées en des premières données,

la transmission, par le capteur (250, 271, 275, 281, 370), des premières données et des premières métadonnées à l'unité d'adaptation RV (255),

l'encodage, par l'unité d'adaptation VR (260), d'informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340), dont des caractéristiques d'objet du monde virtuel, en des deuxièmes données,

la transmission, par l'unité d'adaptation RV/VR (230), des deuxièmes données à l'actionneur (288, 295, 299) en vue d'un actionnement compte tenu des informations en lien avec le monde virtuel (240, 265, 380, 1330, 1340) encodées en lesdites deuxièmes données,

la transmission, par l'unité d'adaptation RV/VR (230), des deuxièmes données à l'unité d'adaptation RV (255),
la réception, par l'unité d'adaptation RV (255), des premières données, des premières métadonnées et des deuxièmes données,

la génération, par l'unité d'adaptation RV (255), d'informations destinées à être appliquées au monde virtuel (240, 265, 380, 1330, 1340) et qui correspondent aux caractéristiques d'objet du monde virtuel, compte tenu des premières métadonnées, des premières données et des deuxièmes données,

l'encodage, par l'unité d'adaptation RV (255), des informations générées en des troisièmes données,

la transmission, par l'unité d'adaptation RV (255), des troisièmes données à l'unité d'adaptation VR (260),

l'obtention, par l'unité d'adaptation RV/VR (230), d'attributs concernant un objet du monde virtuel (265) par décodage des troisièmes données, et

l'application, par l'unité d'adaptation RV/VR (230), des attributs obtenus au monde virtuel (265), lesdites informations en lien avec l'aptitude du capteur (371) comprenant:

l'unité d'une valeur (601) détectée par le capteur,

la valeur maximale (602) que le capteur peut fournir,

la valeur minimale (603) que le capteur peut fournir,

le nombre de positions de valeur (604) ajouté à une valeur de base pour parvenir à une valeur absolue spécifique,

le nombre de niveaux de valeur (605) que le capteur peut fournir entre la valeur maximale et la valeur minimale,

la grandeur minimale (606) du signal d'entrée de capteur requise pour produire un signal de sortie de capteur spécifié, et

le rapport signal sur bruit du capteur.

12. Procédé de traitement de monde virtuel selon la revendication 11, dans lequel l'encodage des informations en lien avec l'aptitude du capteur en lesdites premières métadonnées comprend la génération des premières métadonnées par encodage des informations en lien avec l'aptitude du capteur en un format binaire.

13. Support d'enregistrement non transitoire lisible par un ordinateur, sur lequel est stocké un programme visant à amener un dispositif de traitement de monde virtuel selon l'une quelconque des revendications 1 à 10 à mettre en œuvre le procédé selon la revendication 11 ou 12.

FIG. 1

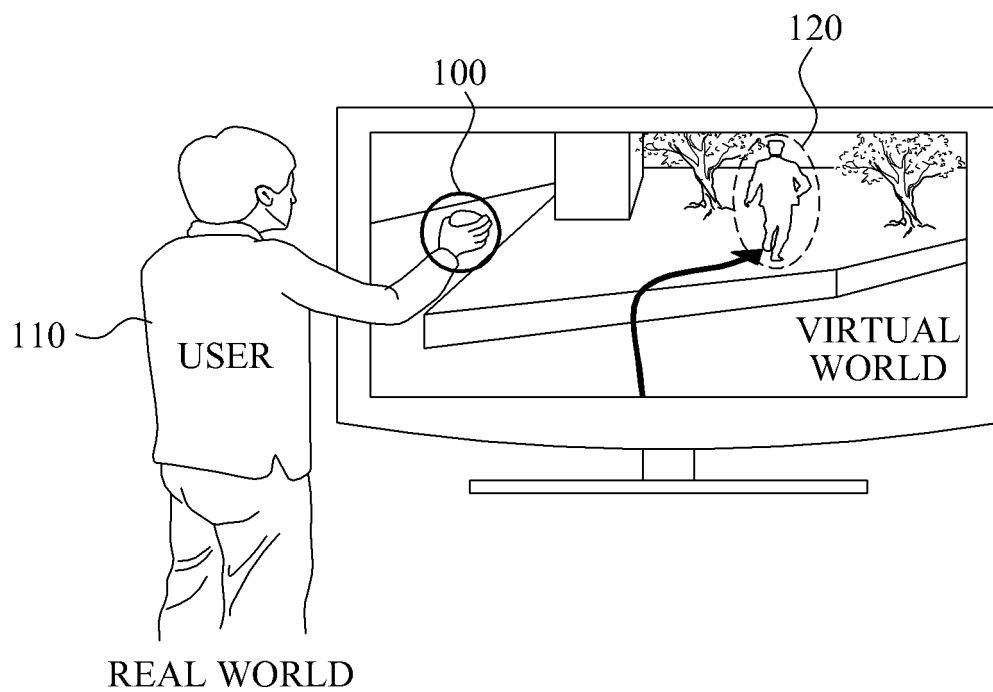


FIG. 2

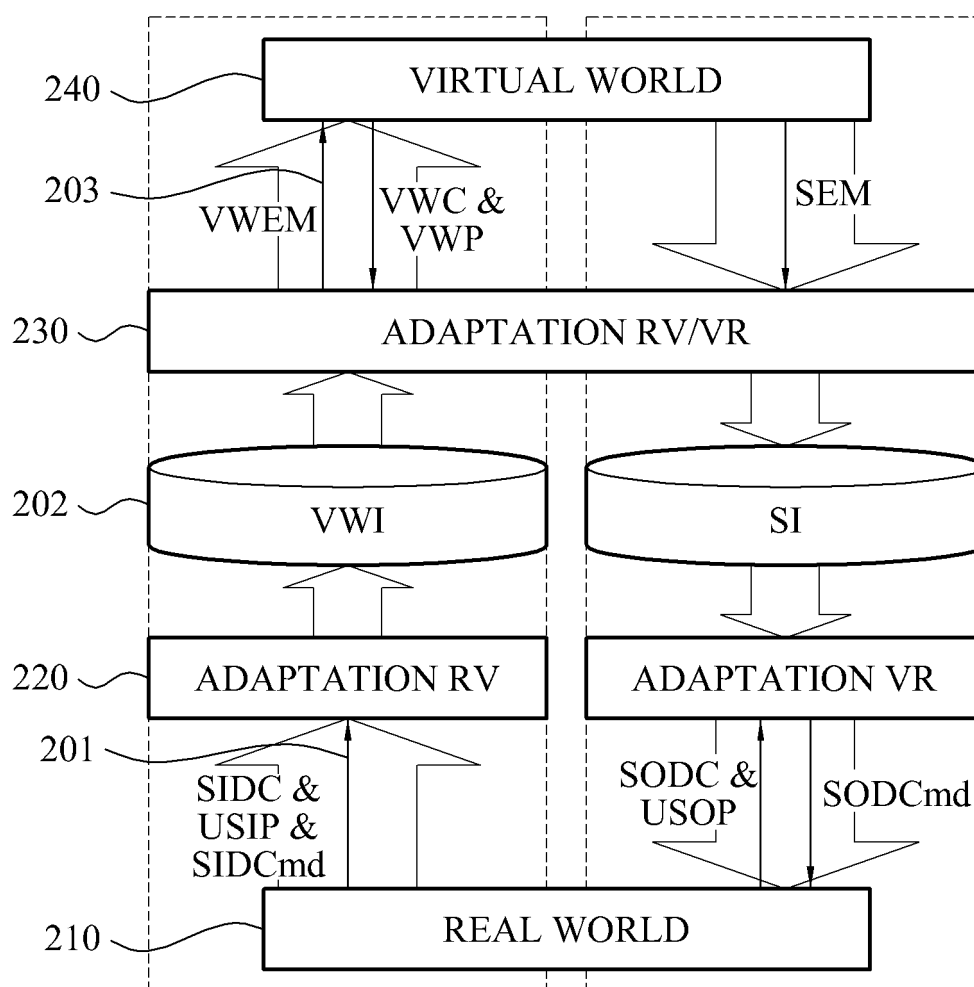


FIG. 3

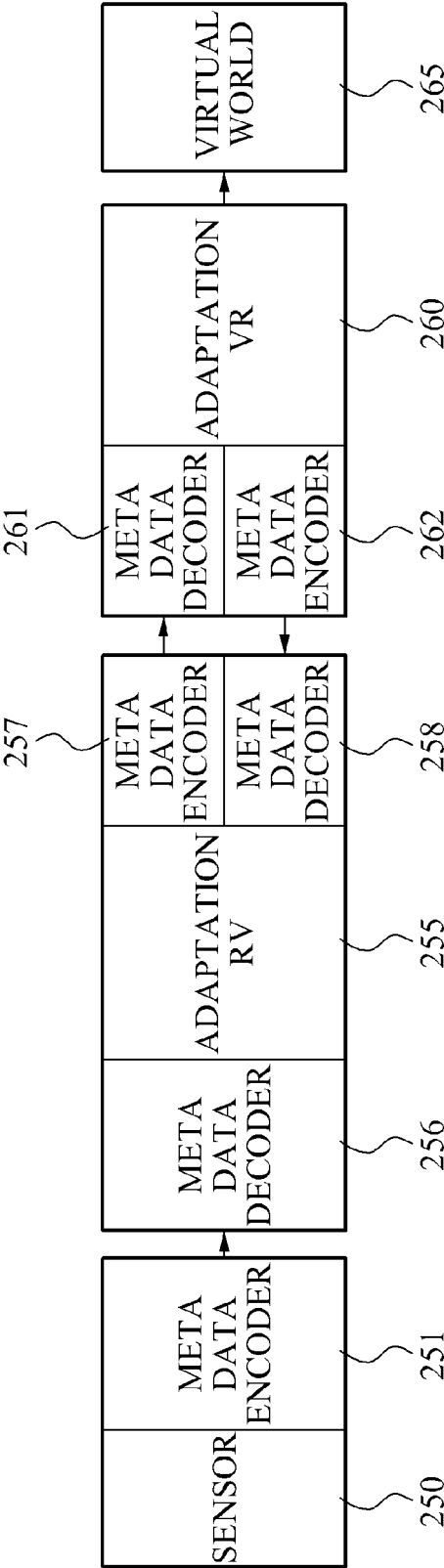


FIG. 4

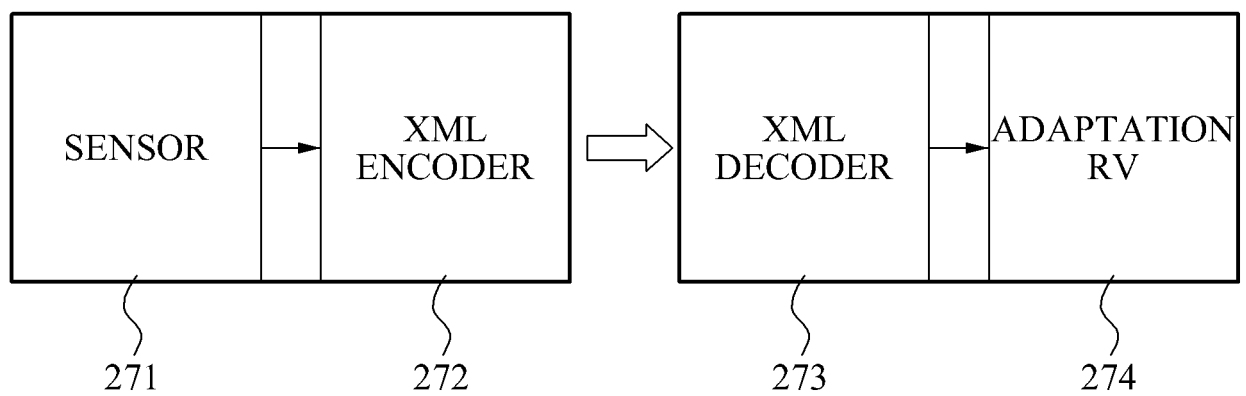


FIG. 5

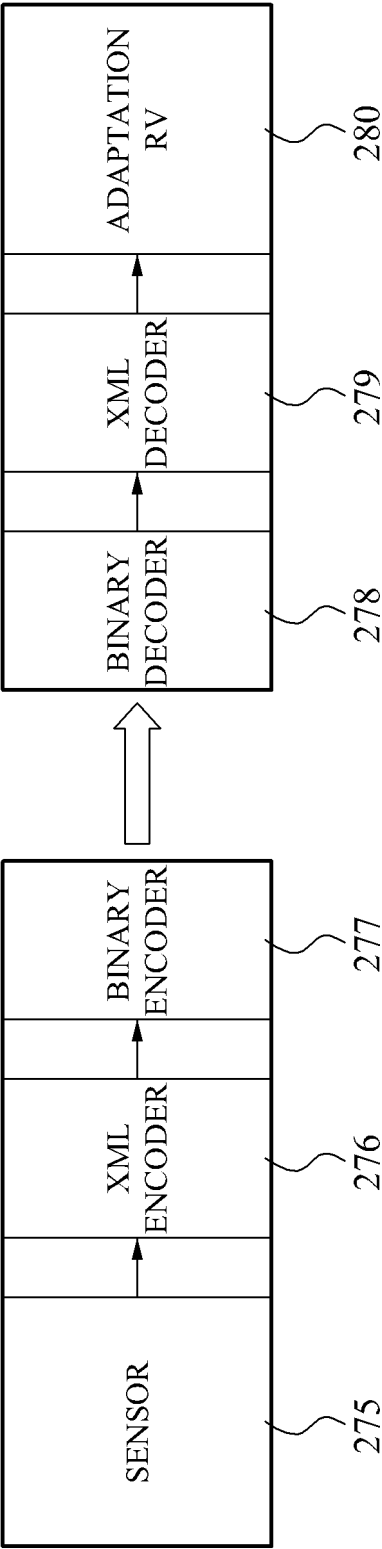


FIG. 6

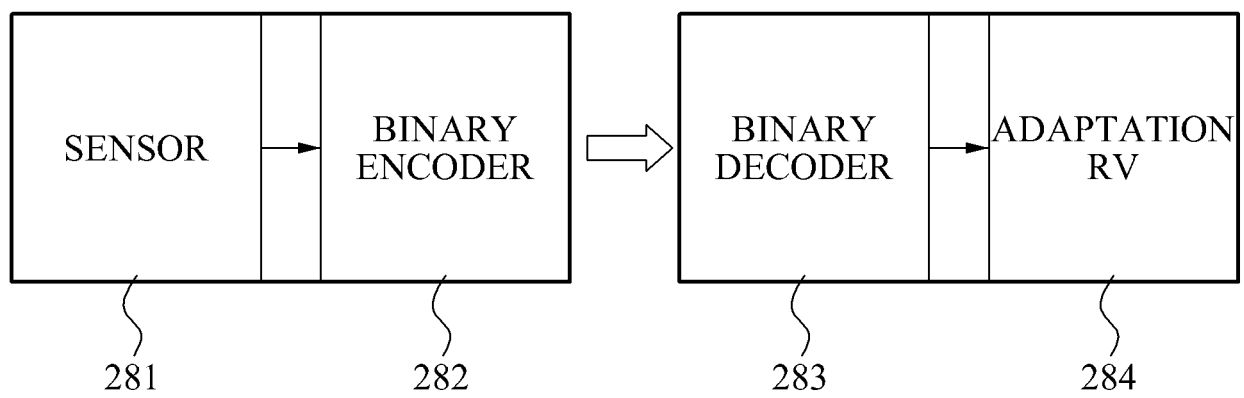


FIG. 7

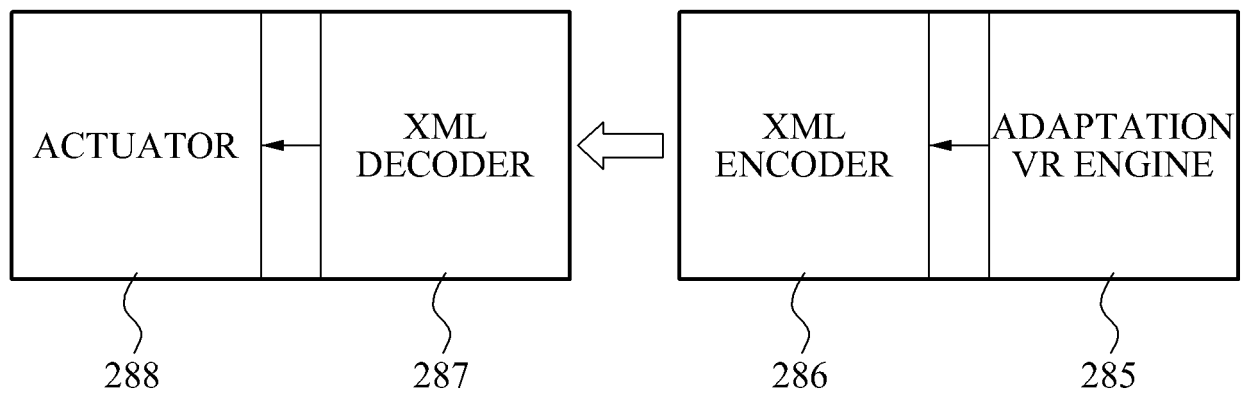


FIG. 8

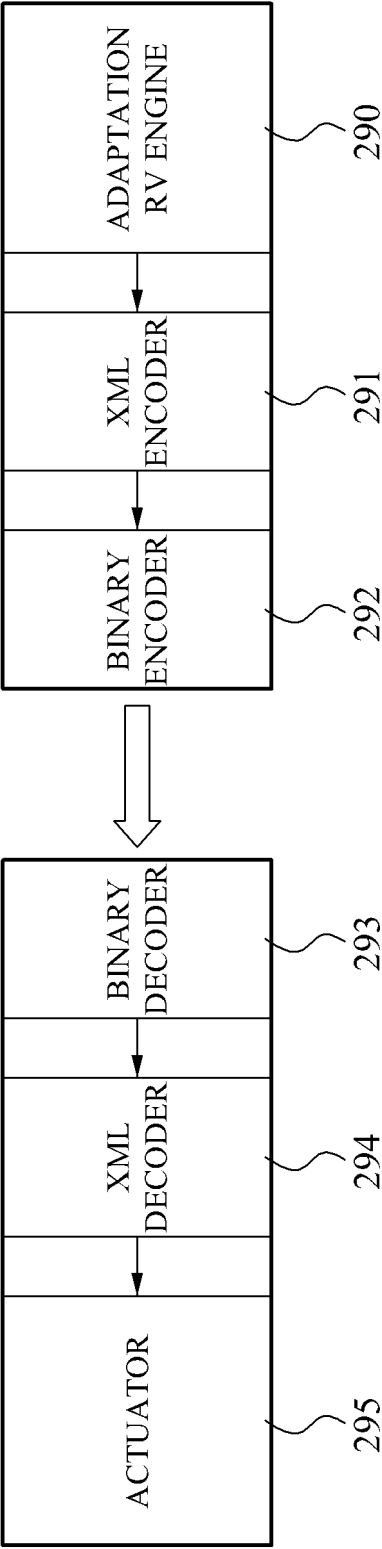


FIG. 9

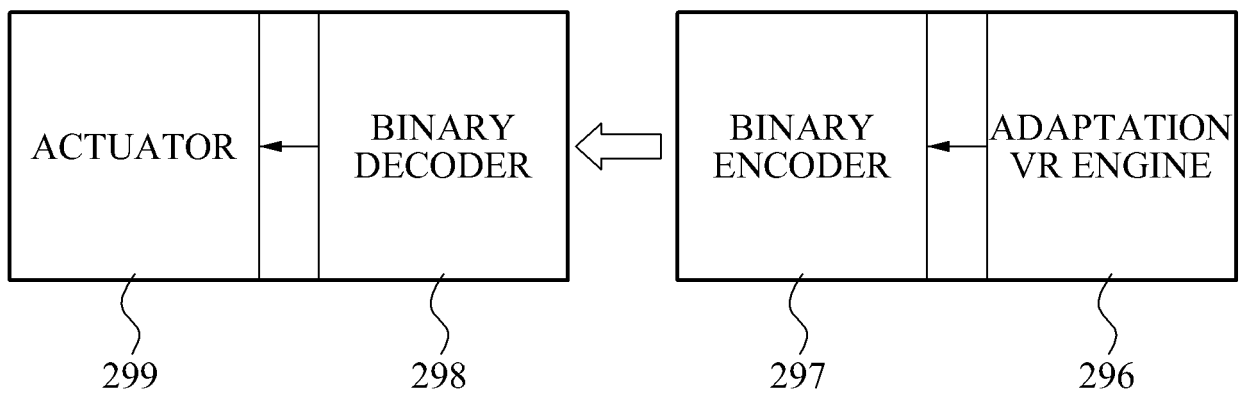


FIG. 10

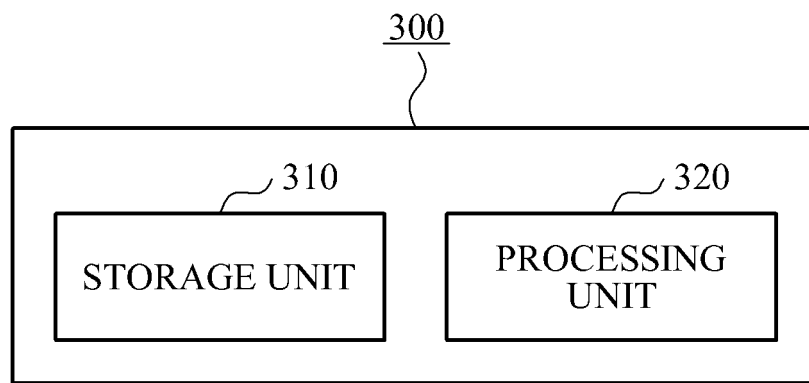


FIG. 11

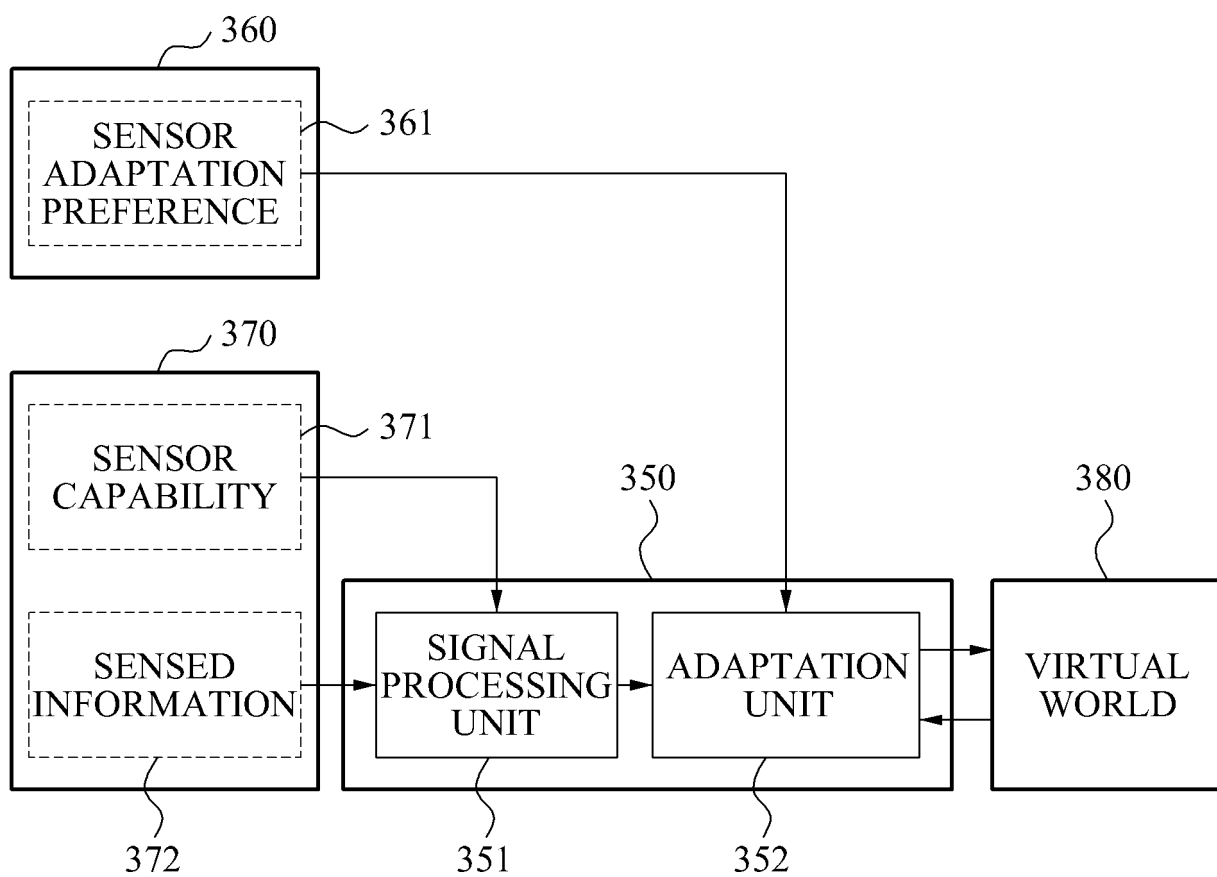


FIG. 12

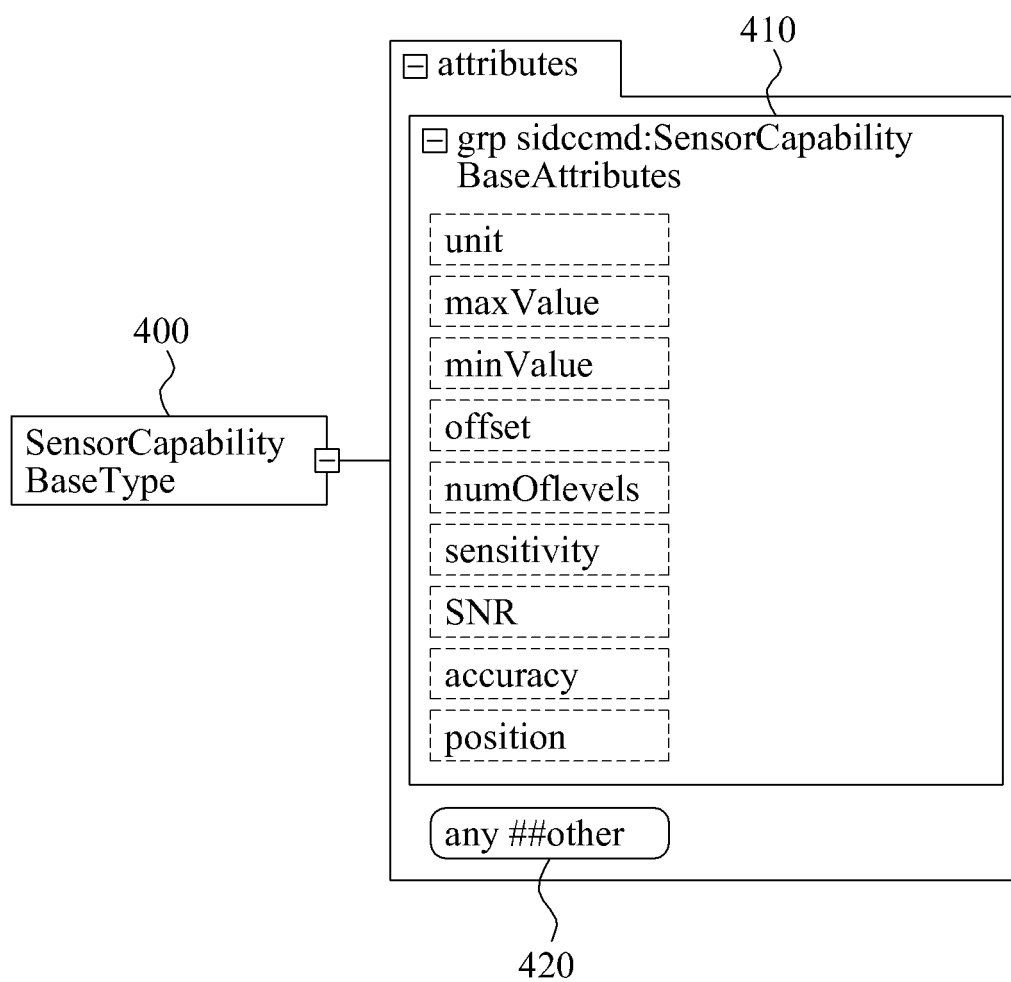


FIG. 13

500

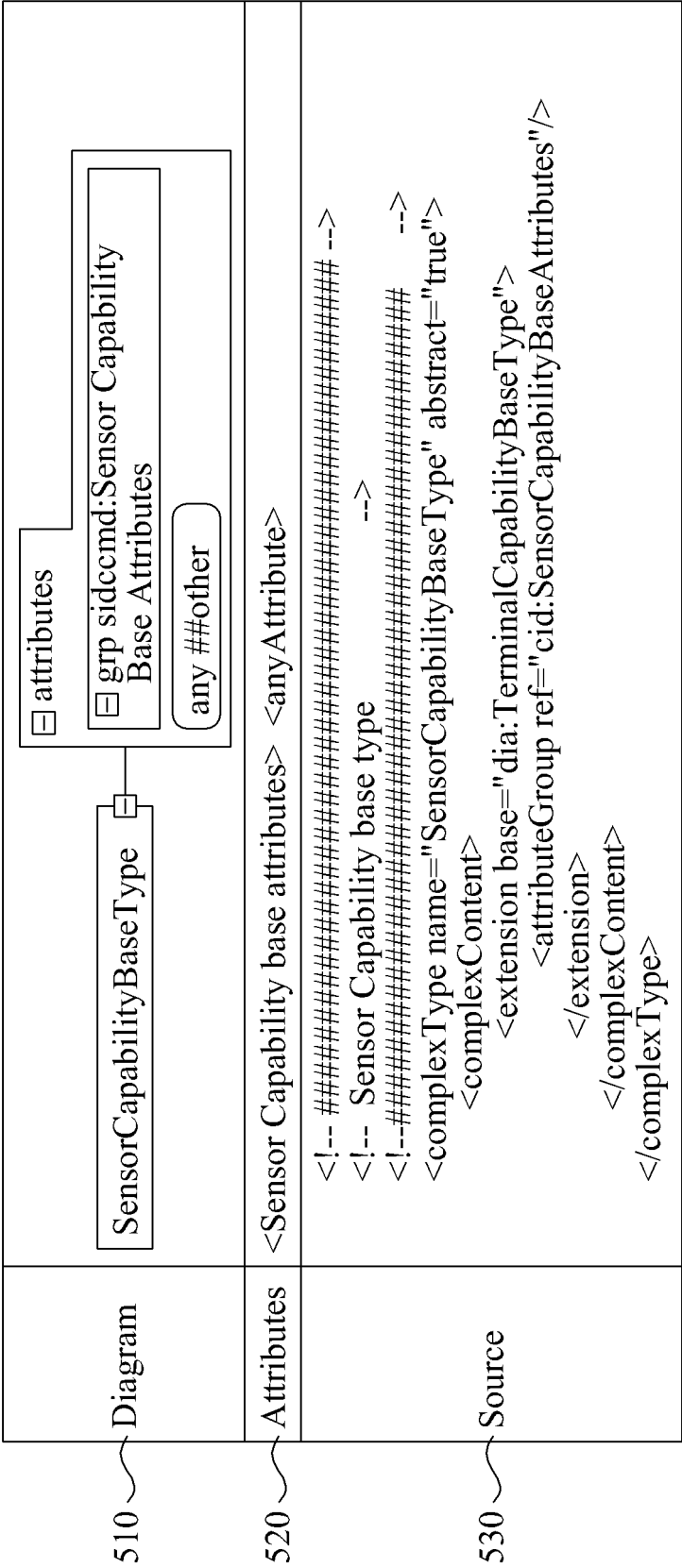


FIG. 14

600

610 Diagram	601 unit 602 max Value 603 min Value 604 offset 605 numOflevels 606 sensitivity 607 SNR 608 accuracy grp sidcmd:Sensor Capability Base Attributes
620 Attributes	<unit><max Value><min Value><offset><numOflevels><sensitivity><SNR> <accuracy>
630 Source	<!-- ##### --> <!-- Definition of SDC Base Attributes --> <!-- ##### --> <attributeGroup name="SensorCapabilityBaseAttributes"> <attribute name="unit" type="cid:unitType" use="optional"/> <attribute name="max Value" type="float" use="optional"/> <attribute name="min Value" type="float" use="optional"/> <attribute name="offset" type="float" use="optional"/> <attribute name="numOflevels" type="nonNegativeInteger" use="optional"/> <attribute name="sensitivity" type="float" use="optional"/> <attribute name="SNR" type="float" use="optional"/> <attribute name="accuracy" type="float" use="optional"/> </attributeGroup>

FIG. 15

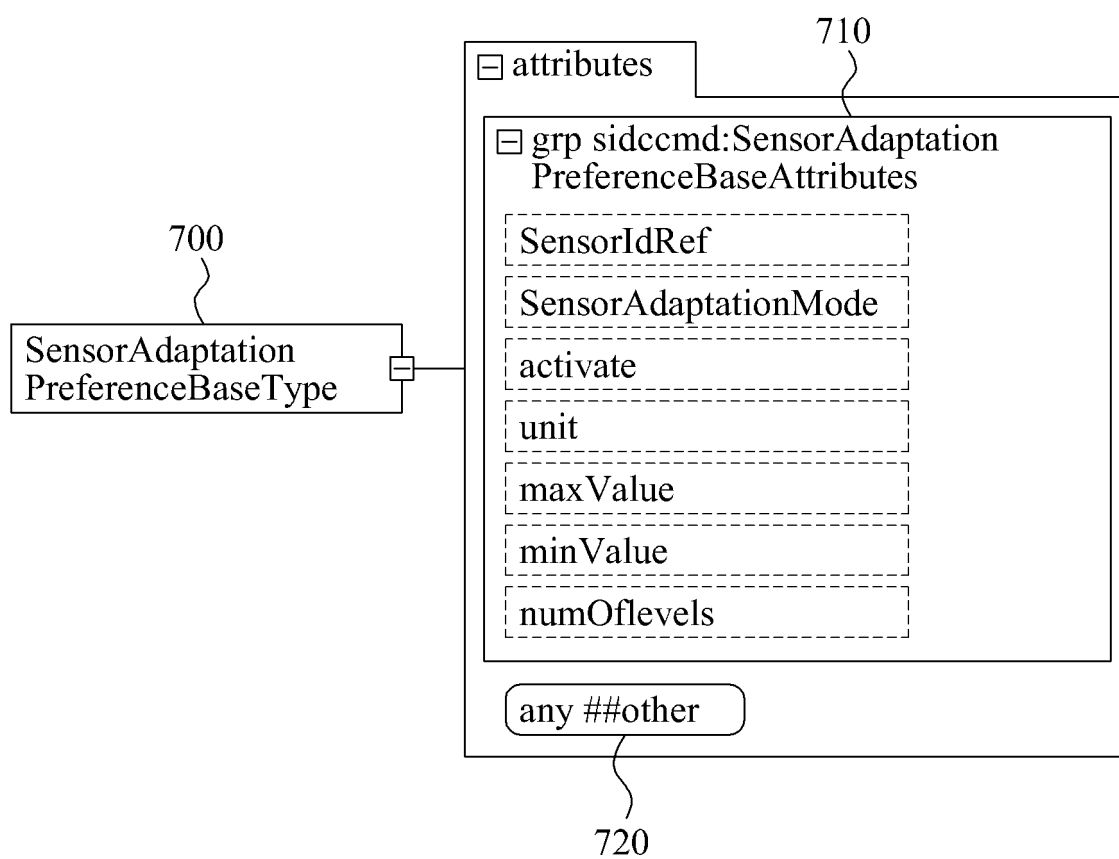


FIG. 16

800

810 ~ Diagram	SensorAdaptation PreferenceBaseType attributes grp sidcmd:SensorAdaptation PreferenceBaseAttributes any ##other
820 ~ Attributes	<SensorAdaptationPreferenceBaseAttributes><any Attribute>
830 ~ Source	<!-- ##### --> <!-- Sensor Preference base type --> <!-- ##### --> <complexType name="SensorAdaptationPreferenceBaseType" abstract="true"> <complexContent> <extension base="dia:UserCharacteristicBaseType"> <attributeGroup ref="cid:SensorAdaptationPrefBaseAttributes"/> <anyAttribute namespace="##other" processContents="lax"/> </extension> </complexContent> </complexType>

FIG. 17

910 Diagram	901 ~ SensorIdRef 902 ~ SensorAdaptationMode 903 ~ activate 904 ~ unit 905 ~ max Value 906 ~ min Value 907 ~ numOflevels	
920 Attributes	<pre><SensorIdRef><SensorAdaptationMode><activate><unit><max Value><min Value><numOflevels></pre>	Attributes
930 Source	<pre><!-- ##### SensorAdaptation Preference Base Attributes --> <!-- ##### SensorAdaptationPrefBaseAttributes"> <attribute name="SensorIdRef" type="anyURI" use="optional"/> <attribute name="SensorAdaptationMode" type="cid:adaptationModeType" use="optional"/> <attribute name="activate" type="boolean" use="optional"/> <attribute name="max Value" type="float" use="optional"/> <attribute name="min Value" type="float" use="optional"/> <attribute name="numOflevels" type="nonNegativeInteger" use="optional"/> </attributeGroup> <simpleType name="adaptationModeType"> <restriction base="string"> <enumeration value="strict"/> <enumeration value="scalable"/> </restriction> </simpleType></pre>	930 Source

FIG. 18

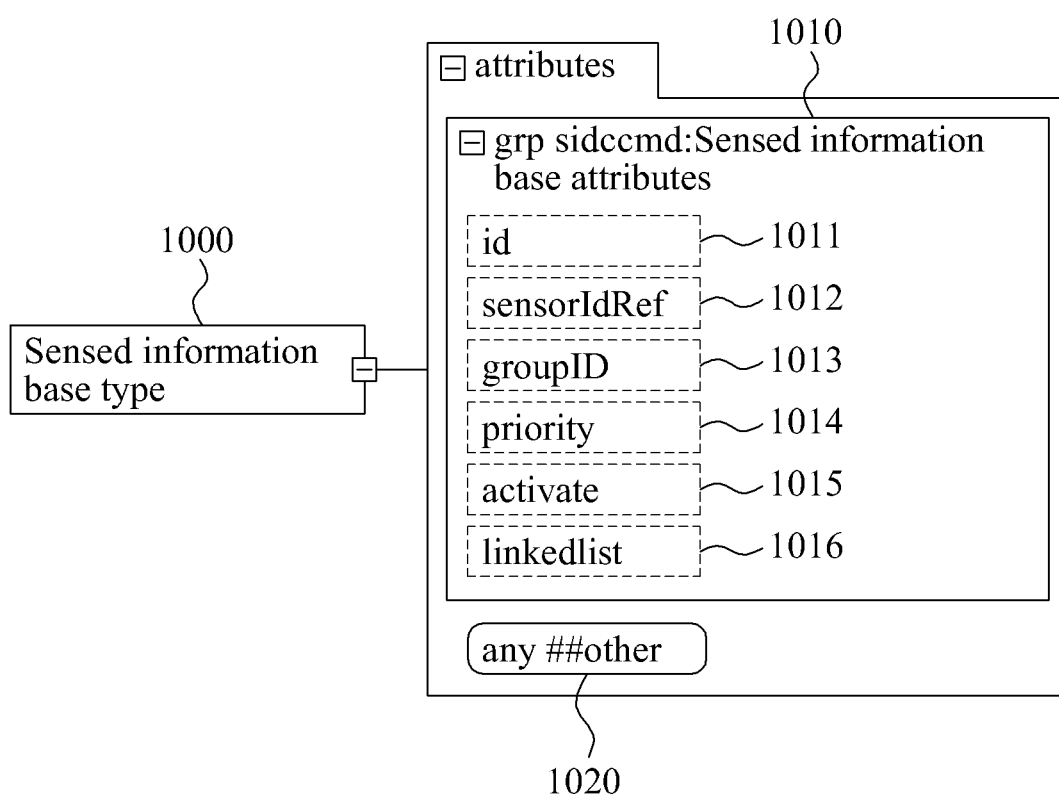


FIG. 19

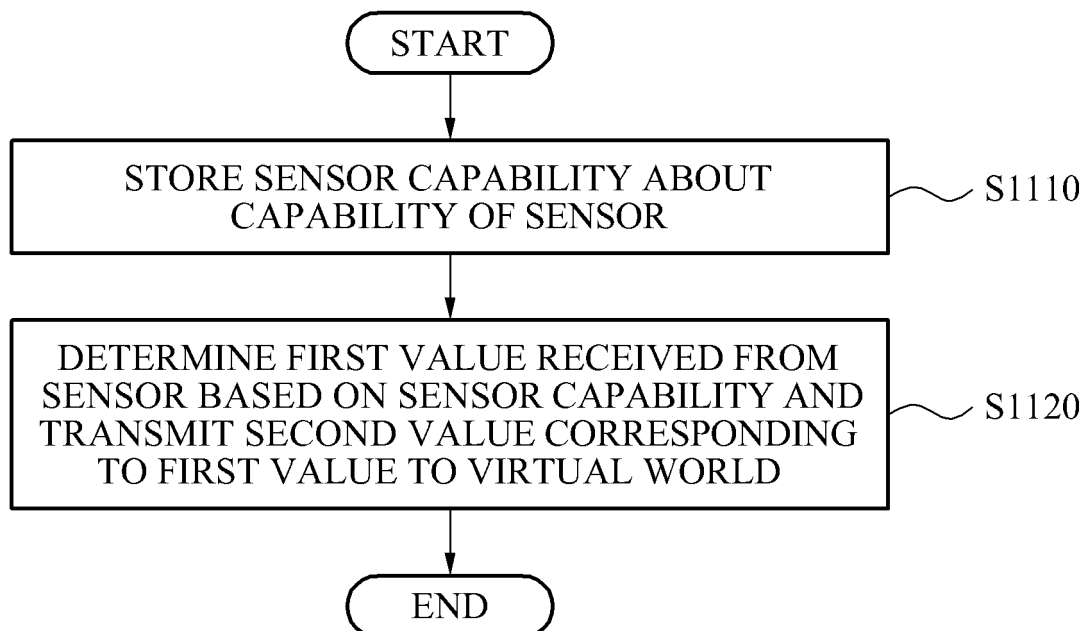


FIG. 20

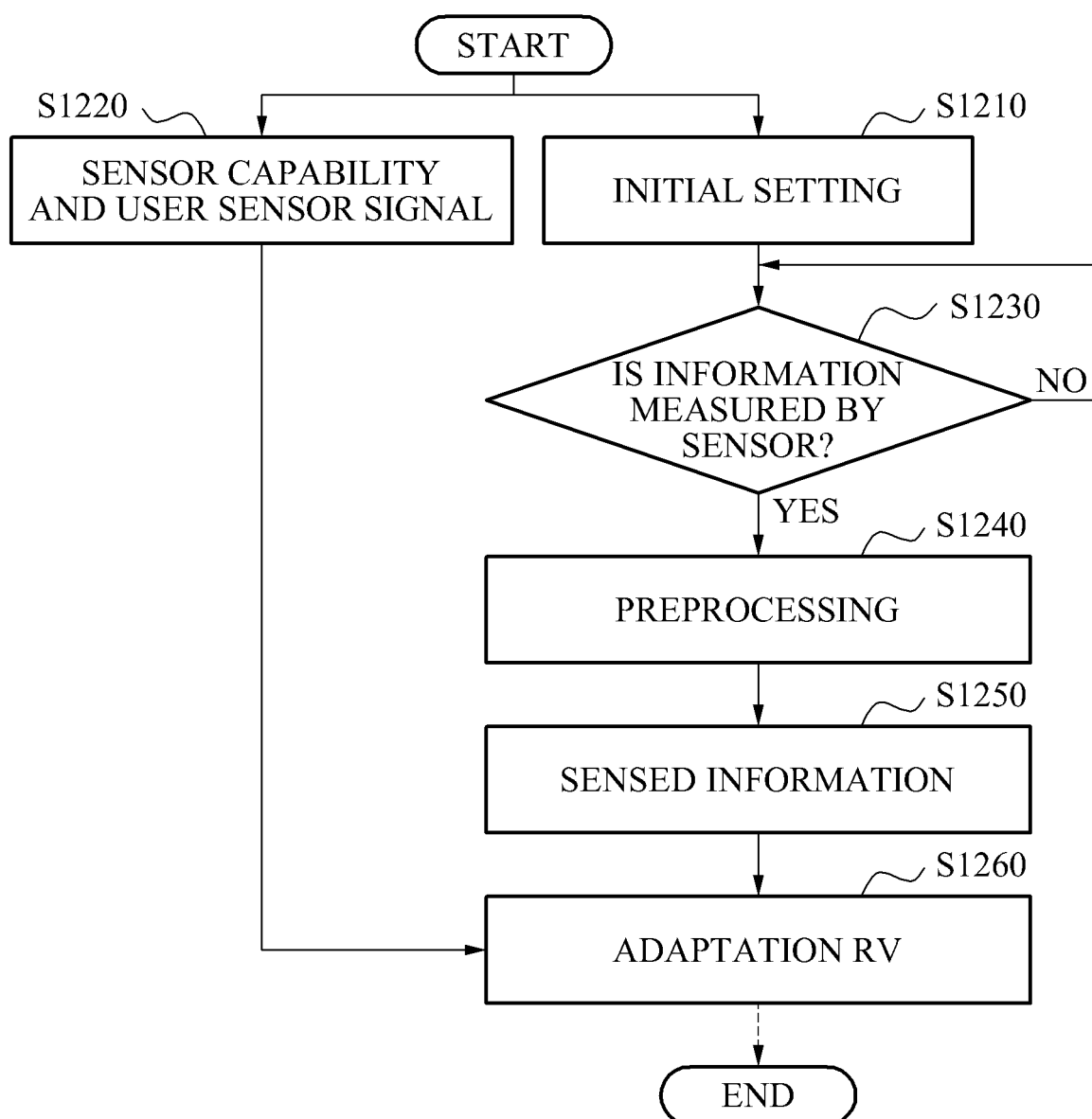
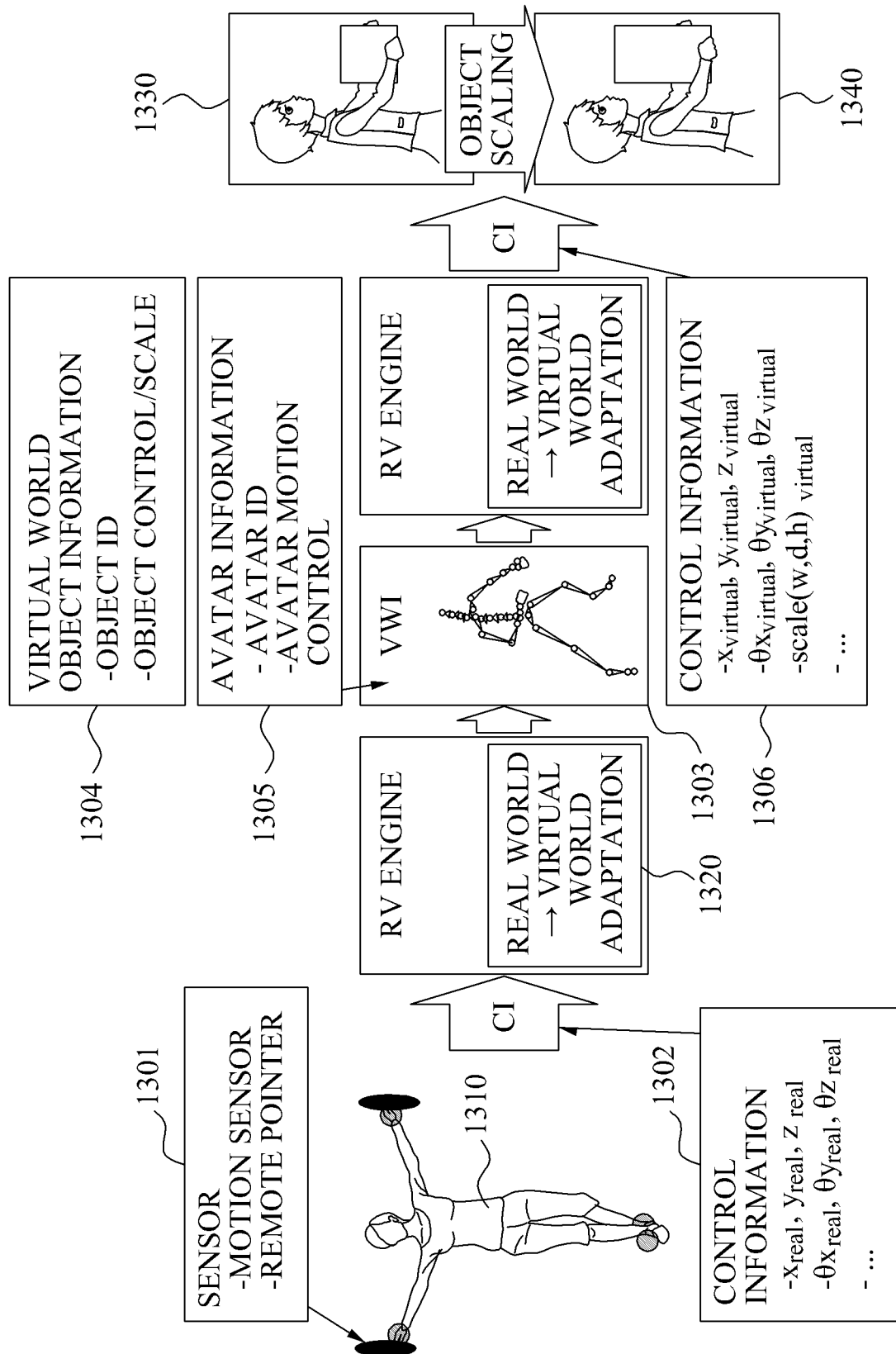


FIG. 21



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 9520788 A [0003]